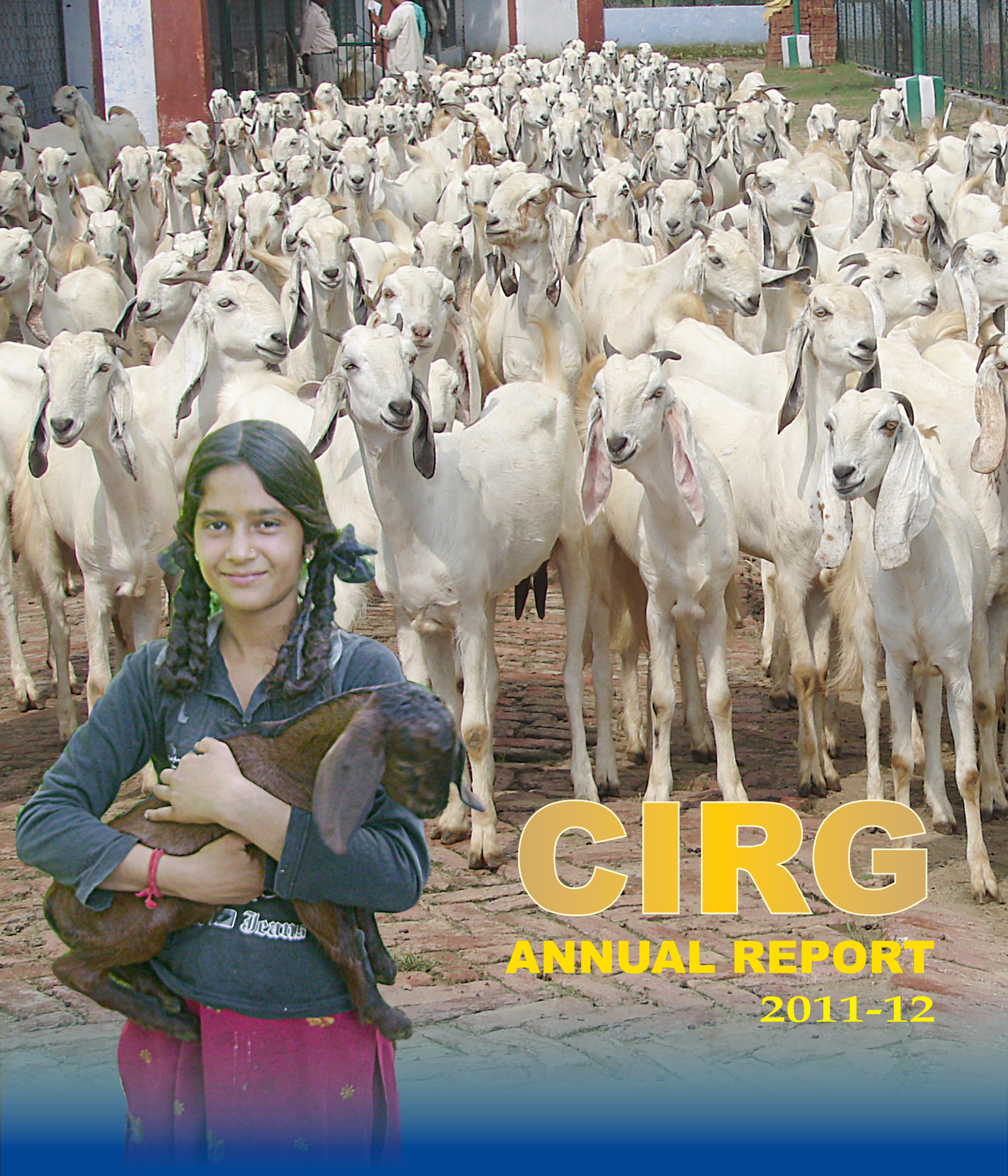


CIRG

ANNUAL REPORT

2011-12

CIRG
1979
MATHURA

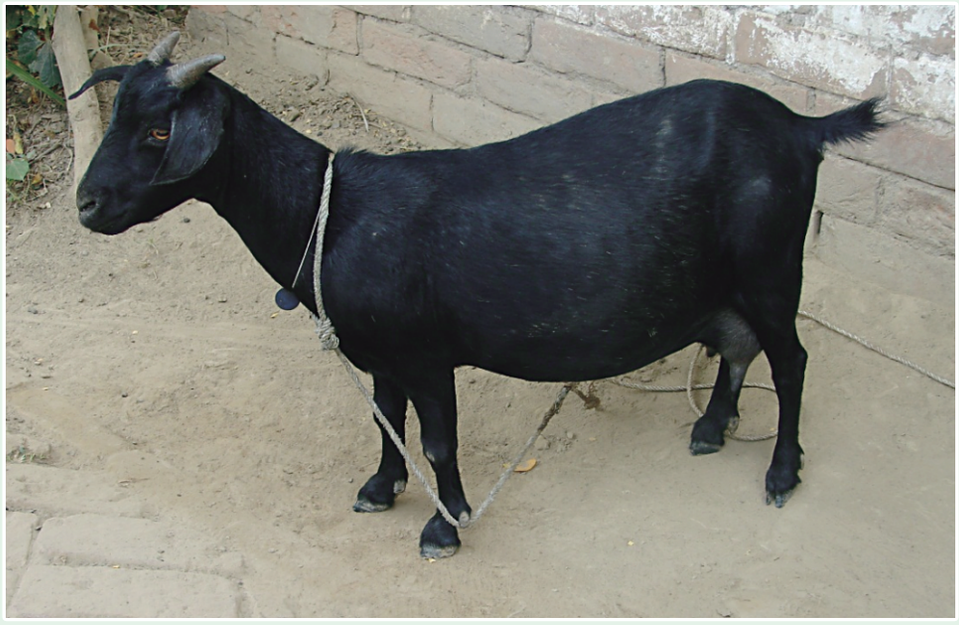
केन्द्रीय बकरी अनुसंधान संस्थान

मखदूम, फरह–281122, मथुरा (उ.प्र.) भारत

Central Institute for Research on Goats

Makhdoom, P.O. Farah-281122, Mathura (U.P.), India

भाकृअनुप
ICAR



Annual Report

2011-12

Goat is the species of choice in the changing face of climate and hence called as

"THE FUTURE ANIMAL"

Dr. S. Ayyappan,
Secretary DARE &
Director General, ICAR,

CIRG
1979
MATHURA

केन्द्रीय बकरी अनुसंधान संस्थान
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CENTRAL INSTITUTE FOR RESEARCH ON GOATS
Makhdoom, Farah-281122, Mathura (U.P.) INDIA

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PREFACE

India with 154 million goats is the largest goat owning country in the world. This large goat population plays a significant role in livelihood and nutritional security as well as in providing supplementary income to over 70 million farmers of nearly 6 Lakh villages in the country. Goats contribute nearly 8.32% of the total GDP from livestock sector to Indian agriculture production system mainly in form of milk (4.3 million MT), meat (586500 MT) and skin (160020 MT), besides producing valuable fiber and manure. The goat husbandry also generates about 4.2% rural employment and millions of small and marginal farmers and landless labourers are engaged in goat keeping. Women are much benefitted by goat rearing as they are the main custodian of these small ruminants in rural areas, especially in Bihar, West Bengal, NEH and many tribal regions in the country. In the recent years, several commercial goat farms have also emerged in different parts of the country, that provide substantial income to progressive farmers. The production efficiency of the present system of goat rearing is reasonably good in comparison to the inputs, which can be enhanced further by providing critical inputs like superior breeding bucks, supplementary feeding with concentrates and cultivated fodders, prophylactic and curative healthcare, improved housing and better marketing facilities.

Research and technological contributions made by this Institute have resulted in development of various improved technologies for enhancing productivity of goats in the country. The major emphasis has been on development of superior germplasm of the indigenous goat breeds that can serve as improver flocks for different regions of the country. The impact of research, extension, training and consultancy programmes undertaken by CIRG on goat production and utilization is apparent in the areas of breed improvement, better reproductive efficiency, effective disease diagnosis and control, and development of feed resources, housing and feeding systems. A significant improvement in quality and quantity of meat and milk in form of increased body weight, kidding rates, slaughter weights, dressing percentage, survivability and lactation yield has been

achieved in the improved goat population as compared to the non-descript population in different regions of the country.

Adoption of technologies for scientific goat rearing by several farmers has enhanced the productivity of their flocks with better financial returns. The significant impact can also be visualized with increase in number of commercial goat farms,majority of which have been established by the progressive farmers after completing trainings on commercial goat farming organized by our Institute. However, there remain many challenges affecting desirable progress in goat production system in our country necessitating a constant evolutionary approach in formulating and implementing research programmes that can generate farmers' friendly adoptable technologies. These challenges were revisited and a policy document in the form of CIRG Vision-2030 was released during the year under report.

The current Annual Report focuses on the achievements and progress made during the year 2011-2012 in the area of research, education and technology dissemination pertaining to different aspects of goat production and health. The year under report has several landmark achievements with successful completion of some of the important programmes undertaken during XI Plan. The year will be remembered in annals of CIRG for one of the most momentous occasions when the institute got prestigious Sardar Patel ICAR Outstanding Institute Award-2010 and also for the record milk production from institute goat

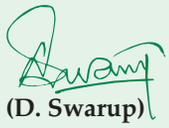
flocks and the number of superior male and female animals supplied to state governments or individual farmers for breed improvement in a single year. For the second successive year, a Muzaffarnagari sheep gave birth to triplet lambs. The mortality remained significantly low in different flocks maintained at the institute. Also there was the record fodder production during the year under report. The success in production of kids through artificial insemination using frozen semen demonstrated that improved reproductive biotechnology can bring about an improvement in the genetic potential of goats. The number of trainings organized during the year was also more than the previous years.

During the year under report, the institute had 13 externally funded projects, two major programmes under AICRP and 21 institutional projects. Selective breeding studies conducted at CIRG have helped in improving the body weight, milk yield and twining ratio in Jamunapari, Barbari and Jakhrana goats. CIRG supplied 689 superior animals of Barbari (366), Jamunapari (212) and Jakhrana (27) goats, and Muzzafarnagri sheep (84) to the farmers and various government agencies for breed improvement. Significant progress has been made in improving the performance of goats in their native tracts through field units functioning at different locations under AICRP on Goat Improvement. DNA finger-printing and other advanced biotechnological tools have been used for genetic improvement of goats. A rapid progress has been achieved in developing various measures to prevent and control different economically devastating goat diseases. The pilot studies have shown encouraging result for development of herbal medicated complete feed that can be recommended for prevention and control of kid mortality. Research work on development of supplementary and complete feeds using low grade roughages and agro industrial byproducts will be further strengthened by taking up processing and storage studies on green and dry fodder. The institute has developed several novel meat and milk products for commercialization, that maybe highly beneficial to provide remunerative prices for goat products.

Researches at CIRG are mainly focussed to achieve technological and institutional innovations to enhance the income of mainly poor goat keepers. We are trying to demonstrate the available improved technologies at the farmers' doorstep. A concerted approach has been adopted by the Institute in this direction. During the year 2011-12, the institute organized 4 National Training Programmes on Commercial Goat Farming and 11 sponsored trainings on Scientific Goat Rearing, which were attended by 445 farmers/veterinary officers/livestock extension officers, and entrepreneurs. Importantly, the institute also organized two sponsored training programmes for women, which were attended by 47 participants. These trainings have become extremely popular amongst the goat keepers of the country. The dedicated helpline is working to address the goat farmers' problems.

The institute filed 10 patent applications during the year under report, and a strain of *Mycobacterium avium* subspecies *paratuberculosis* genotype 'Indian Bison type' strain 'S 5' of goat origin has been transferred to M/S Biovet (P) Ltd. for development and commercialization of indigenous vaccine against J.D.

I sincerely express my sincere gratitude to Dr. S. Ayyappan, Secretary DARE, and Director General, ICAR, for his dynamic leadership and strong support for the overall development of the Institute. I am indebted to Dr. KML Pathak, DDG (Animal Sciences) for his ever encouraging support for the progress and success of the institute. My thanks are also due to Dr. Gaya Prasad, ADG (Animal Health), Dr. S.C. Gupta, ADG (AP&B) and Dr. B.S. Prakash, ADG (Animal Nutrition and Physiology)and other scientists of SMD and Chairman and members of RAC and IMC of the Institute for their valuable guidance and support. A word of appreciation for editorial team for their untiring efforts for compiling this document and to the Head of Divisions, all scientists, technical, ministerial and supporting staff of CIRG for their active involvement and support for the landmark achievements during the year 2011-12.



(D. Swarup)
Director

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CIRG

Farmers innovative goat house at Vapi under AICRP unit, GAU, Navsari

A field unit of Ganjam goats under AICRP on goat unit, OUAT, Bhubaneshwar

Annual Report 2011-12

EXECUTIVE SUMMARY

In the present scenario of rapidly declining availability of natural resources, goat is the most valuable animal that can provide nutritional as well as financial security to millions of resource poor people in the country. Among all species of farm animals, goats have the widest ecological range and have been poor people's most reliable livelihood resource since their domestication during Neolithic Revolution about 10 millennia ago. Goats possess distinct social, economical and biological advantages. They can be maintained on a limited area and can sustain on wide variety of vegetation in varied agro-climatic conditions. Goats are easy to manage and their small size makes them suitable for home slaughter. Goat meat (chevon) is one of most preferred meat type by the consumers in several countries including India. The goat milk is easily digestible due to smaller size of fat globules and serves as a ready source of family nutrition. In India, both demand and production of goat meat have shown steady increase during the last decade and despite the rising production trend, country would need to double the number of goats to meet the projected requirement of goat meat for growing human population in the coming decades. However, the increase in livestock number would definitely put more stress over limited natural resources.

Management of feed and fodder resources is crucial for the future development of goat production in the country. There is very little scope for increasing the area under fodder production, keeping in view the priority for food grains, pulses and oil seeds. Therefore, concerted efforts are required to develop technology for enhancing per animal productivity, besides increasing the productivity of fodder per unit area and utilization of the waste lands and newer non-conventional feed ingredients for goat production. Innovative research strategies need to be formulated to ameliorate impact of climate changes on health and productivity of animals. Research programmes for conservation and genetic improvement of indigenous goat resources and use of molecular genetics in understanding gene expression and variability and causes of genetic diversity need to be strengthened. Food management, food safety and value addition studies and green house gas mitigation technologies are important to address issues pertaining to eco-friendly sustainable goat production system. Disease occurrence leads to considerable economic losses and control of diseases is very relevant in present era of bio-security, safe food and 'one-health'. Control of parasitic diseases, JD, brucellosis, PPR, blue tongue,poxand other emerging and re-emerging diseases is particularly important to augment goat production in the country without multiplying number of animals. Research directed towards newer generation vaccines, diagnostics and drugs can be an effective tool for disease control. The unorganized market system is a major hurdle for goat farmers to fetch remunerative price. There is an absolute necessity for market oriented livestock production system and vice versa.

The poor man's cow- goat has tremendous potential to be projected as the 'Future Animal' for rural prosperity under the changing agro-geo-climatic conditions and depleting resources. India with 154 million goats is the largest goat owning country in the world. This large goat population plays a significant role in livelihood and nutritional security as well as in providing supplementary income to nearly 70 million farmers of over 500,000 remote villages. Goat husbandry in India is essentially an endeavor of millions of small holders who rear animals on "Crop Residues" and "Common Property Resources". The small holders produce milk, meat, fiber, skin etc for the

community with virtually no capital, resource and formal training. More often goats are reared for production of meat, but they also serve as a ready source for milk to meet the family requirement. In India, considerable growth has been recorded in production of goat meat and milk during the last decade. The goat meat production has doubled (9.3% to 18.3%) and goat milk production has shown a growth rate of 31.53% during the last decade. The country stands first in goat milk production and is the second largest meat producer in the world sharing 26.31% goat milk and 10.41% goat meat production. Besides meat and milk, goats also produce good quality skin, valuable Pashmina fiber and manure.

The research programmes at CIRG are undertaken by four existing divisions. The extension education, socio-economic aspects of goat husbandry and training to various stakeholders are dealt by the EE&SE section.

Genetic Improvement Programme

The major emphasis has been on selective breeding for improving production performance, conservation of goat breeds in their home tracts and gene marker studies for enhancing selection decision to increase productivity in goats. Selective breeding of Jamunapari, Barbari, Jakhrana goats and Muzaffarnagari sheep has established promising genetic progress in body growth, milk yield and twining ability over the years.

During 2011-12, a total of 689 animals of Jamunapari, Barbari, Jakhrana goats and Muzzafaranagri sheep were supplied to various agencies and goat breeders for conservation and genetic improvement. During the year under report population growth of Jamunapari flock was 100.80% and overall mortality of the flock was 3.62%. The heritability estimates for milk yield traits were moderate. The mortality % in Barbari flock was 4.4%. Highest milk production in Barbari was observed in 4th and 6th parities. Three hundred and sixty six superior Barbari does and bucks were distributed for grading up, conservation and genetic improvement of farmers flock to state government and other developmental agencies. Milk yield of 30, 60, 90, 120 and 150 days of Jakhrana does kidded in 2011-12 increased by 26.85 %, 25.95 %, 28.63 %, 44.47 %, and 53.57 %, as compared to does kidded during 2009-10. Average per day milk production of Jakhrana goats was 1.15 liter up to 150 days.Genetic variation was analysed in goat calpastatin gene in Sirohi (30), Jamunapari (30), Jakharana (20) and Barbari (27) breeds and no variation between individuals was found. The overall mortality in Muzaffarnagri sheep was 2.64 %. The mean body weights of lambs were 2.83, 11.93, 19.45, 22.86 and 25.63 kg at birth, 3, 6, 9 and 12 month age, respectively. On comparison, it was observed that the performance under field was 0.780, 5.780, 2.00, 1.990 and 3.210 kg. lower than farm animals at respective age. Under the project on goat husbandry based integrated approach for livelihood security in Bundelkhand region, the improved measures resulted in decrease in goat mortality and increase in income of farmers to the tune of Rs 600/kid/year. Work carried out under bioprospecting of genes and allele mining for abiotic stress tolerance indicated that genotype had significant effect on biomarkers. The genotyping by HRM analysis showed four different genotypes in the analysed samples.

Physiology, Reproduction and Shelter Management Programme

During the year, frozen semen bank of Jamunapari, Barbari, Sirohi and Jakhrana goat breed was strengthened. Nineteen kids were born by artificial insemination using frozen semen. Success in producing partheno-genetically activated embryos was also achieved. Parthenogentically produced embryos were transferred to synchronized recipients. Six kids were born through MOET. Inhibin immunization with a single booster dose resulted in increase in the ovarian activity

and improvement in fertility. Research on managemental interventions for augmenting growth established the beneficial effect of natural probiotic feedings in reducing weaning stress in kids. Adaptability of goats in changing environment due to climate stress was studied during the hot dry and hot humid climate. Thatch housing was found to be more comfortable during hot dry season but asbestos housing was better suited during hot humid season. Improved livelihood security of farmers of Rae Bareli district has also been achieved through distribution of superior genetic goat germplasm of Sirohi breed.

Nutrition, Feed Resources and Products Technology Programme

The green legume fodders of Moong *(Vigna radiata)* and Guar *(Cyamopsis tetragonloba)* during kharif were quality feed for goats with dry mater intake respectively 2.48 and 2.93 percent of live weight, while Lobia (*Vigna unguiculata*) fodder had DCP 12.45 and TDN 58.82 %. Among three pastoral systems (natural, *Cenchrus ciliaris* pasture and *Zizyphus* based silvipature) of goat management *Cenchrus ciliaris* pasture provided optimum dry matter intake 2.4 to 2.81 per cent of live weight during summer. Seasonal and breed variations was noted in milk constituents of goats being maintained at farm. Among the four goat breeds (Barbari, Jakhrana, Jamunapari and Sirohi), milk of Jakhrana had the higher fat (4.04%) content. Higher fat (4.04 %) in goat milk was recorded during rainy season whereas higher SNF content (8.07 %) was found during winter. Milk total solids had significant and positive influence on paneer yield. Formulations of herbal based goat meat nuggets having CGH 1 at 0.5 %, CGH 2 and CGH 3 at 0.25 produced acceptable quality of product in respect of color and softness. Inclusion of aloe vera gel at 5 % in goat meat nuggets reduced proportion of C6:0 and C18:0 in the product, which was softer, had more mono-saturated fatty acids with shelf life 21 days at 4^0C. A 10 % sweet lemon albido incorporation in goat meat nuggets improved softness of the product, which contained more dietary fiber hence product was more functional in nature. Methane production (ml/ g DM) of crop residues (Gram straw, arhar straw, wheat straw, lobia straw and guar straw) ranged from 4.2 to 24.63 ml, while top feed resources (Leaves of Peepal , neem , ber , siris , subabool , remja, chonkra , mulberry and mixed leaves) produced 1.65 to 7.18 ml methane; supplements (energy and protein) and their combinations emitted methane in the range of 1.32 to 12.08 ml at t1/2 of *in-vitro* gas productions. Supplementation of Cu and Zn in adult male goats enhanced growth, while chelated sources of Cu and Zn provided higher immunity status. Improved male reproductive performance upon Cu and Zn supplementation includes enhanced sexual desire, higher sperm motility and reduced numbers of abnormal sperms. A total of 42 fiber degrading bacteria from goat rumen were isolated and 11 were characterized for improved fibrolytic activities and submitted to Veterinary Type Culture Collection Centre (VTCC). Inclusion of herbal anticoccidial and antimethanogenic preparations in pelleted goat feed (R:C; 60:40) improved growth performance, reduced coccidial infestation and lowered methane emission.

Goat Health Programme

Goat health programmes are intended to undertake and execute research to provide better healthcare and prevention and control of economically important goat diseases. Surveillance and monitoring of goat diseases revealed that PPR, Goat Pox, Enterotoxaemia, Contagious Caprine Pleuro Pneumonia and Parasitic diseases were important diseases under field conditions. *E. coli, Cryptosporidium* spp. and rotavirus were found main causative agents for neonatal diarrhea in kids. PCR detection of Rotavirus form diarrhoeic goat faeces was developed.Herbal formulation with therapeutic effect against *E. coli* diarrhea in goats was developed for goats. Trials with

herbal formulation with anti-coccidial and anti-methanogenic effect were also conducted for field evaluation. Molecular characterization and phylogenetic analysis of *Brucella melitensis* isolates of goat origin were completed. Methodology for detection of *Cryptosporidium* spp. oocysts in goat faecal smear by differential staining was developed and standardized. Process for concentration of oocysts from kid faeces and their detection in unstained preparation was also standardized. The significance of *Cryptosporidium* spp. in causation of neonatal kid diarrhea and the association of *Toxoplasma gondii* with abortion in goats were established. rSAG1 ELISA for serological detection of caprine toxoplasmosis was standardized. *Listeria* monocytogenes was isolated from case of inflammatory brain diseases. Procedure for isolation and characterization of bacteriophages for use against Staphyllococcal mastitis was developed. PPR Virus was isolated from field outbreaks of PPR among goats in Mathura district. Strain of MAP ('S 5' Indian Bison Type) for production and standardization of inactivated JD vaccine was transferred to Biovet (P) Ltd., Initiatives have been taken for transfer of Indigenous ELISA kit for diagnosis of JD. Human samples form suspected colitis, IBS, diabetes cases were screened for MAP under outreach programme on zoonosis.

Extension Education and Socio-Economics Programme

Under Extension education and social economic programmes, technologies and practices developed in the Institute are transferred to goat farmers of adopted villages. A total of 349 goats were vaccinated against FMD, HS, ET and PPR. Deworming was done in 38 animals. Group discussions were conducted encompassing various areas like shelter management, care of pregnant goats, nutritional interaction and vermi-compost in the adopted village. Regular healthcare of animals, improving native germplasm by supply of superior breeding bucks and pregnancy diagnosis were also done in the adopted villages.

Different value chain for goat market were identified. Main purposes of selling or buying goats, determinants for price of goats and constraints in marketing were also searched out. Adoption of different improved technologies by farmers and reasons for non-adoption were also studied. The impact of training programmes was found highly encouraging as several trainees have started goat farming on commercial scale. But, illiteracy and gap in knowledge were the main factors responsible for inaccessibility of critical inputs. Economic and social status of different goat farmers in adopted villages were sorted out and technologies transferred under TOT programmes were assessed. Four National training programmes on Commercial Goat Farming and 11 sponsored trainings on scientific goat rearing were organized. Answered 1801 calls on helpline service, and 1416 visitors were provided advice on different aspects of goat rearing. CIRG participated in 9 National and International Fairs/Exhibitions.

CIRG : AN INTRODUCTION

Considering the significance of goats in a agrarian economy of India, The Indian Council of Agricultural Research established a National Goat Research Centreat Makhdoom, Farah in Mathura district of Uttar Pradesh on 12th July, 1976. The centre got the status of a fullfledged Institute on 12th July, 1979 and named as Central Institute for Research on Goats. The Institute is located almost at equidistance from two famous places–Mathura (22Km), the birth place of Lord Krishna, and Agra (32Km) the abode of world famous Taj Mahal. Director is the head of Institute and its apex body like IMC, RAC and QRT guide its research and other activities. Presently 33 Scientists, 72 technical and 32 administrative personnel share the responsibility to achieve mandate of the institute, which has 4 research divisions and one section including well equipped Library, ARIS cell, PME cell, Agricultural farm, IPR Cell, Livestock farm and Health Section. The Co-ordinating unit of All India Coordinated Research Project is also located at CIRG. The project aims at improving production performance of 13 breeds of goats distributed in different regions of the country under farm and field conditions. The Institute is well connected with modern information and communication facilities comprising landline phones 0565-2763380, 2763323. The profile of the Institute can be visited at www.cirg.res.in.

Vision

"Develop Poor Man's Cow-the Goat as a Source of Livelihood Security, Poverty All eviation and Employment Generation for the Small holders"

Mission

The mission is to enhance and then sustain goat productivity inrespect of meat, milk and fibrethrough research, extension and HRD support.

Mandate

The mandate of the Institute is to undertake research, training and extension education programmes for improving milk, meat and fibre production of goats and to develop processing technology of goat products.

Objectives

1. To undertake basic and applied research in all disciplines relating to goat production and products technology.
2. To develop update and standardize area specific package of practices on breeding, feeding, management and prophylactic and curative health cover of goats.
3. To impart National and International trainings in specialized fields of goat research and development.
4. To transfer technologies for improving milk, meat and fibre production and value addition of goat products.
5. To provide referral and consultancy services on goat production and product technologies.

Salient Achievements during XI Plan

- Improved reproductive performance resulting in higher population growth in Jamunapari (94.65%) and in Barbari (183%) goat flocks maintained at CIRG
- Positive genetic trend with improved body weight at birth, and at 3, 6, 9, and 12 month of age in Jamunapari goats, (0.12±0.03, 0.59±0.12, 1.58±0.19, 2.66±0.28 and 2.14±0.36, respectively) and at 9 month (0.999±0.213 kg) in Barbari goats

- Significant improvement in milk yield has been achieved in Jamunapari, Barbari and Jakhrana goats compared to their base population performance. In 2010-11 27.53% Jakhrana does had the peak yield >2 litres milk per day
- Established genetic origin of Indian goat breeds and genetic variation in Myf, leptin , Pit I, FecB , SCD gene, HSP genes in Indian goats
- Heat stress tolerant genes (AP-2 binding site in the promoter region of hsp70.1 gene, Melanocortin 1 receptor (MC1R) gene, Tyrosinase (TYR) gene and Signal transducer and activator of transcription 5 A (STAT5 A) gene were characterized in goats to facilitate further studies on resilience of goat production system under changing climate
- Established milk proteomics for Jamunapari, Barbari, Jakhrana, Marwari and Sirohi breeds of goats
- Genetic parameters of Indicator traits of GIN infection were established , and also quantified the relationship between indicator traits with growth parameter at the genetic, phenotypic and environment level
- Created of frozen semen bank for Jamunapari, Barbari, Jakhrana and Sirohi breeds of goats, and standardized frozen semen technology using antioxidant based semen extender for successful AI in goats
- Standardized IVF technology in goats, and successfully produced 3 IVM/IVF kids
- Complete feed pellet for efficient growth (80g/d) in finisher kids has been developed
- Optimum ratio of cotton seed : linseed cake for goat feed for better reproductive and growth performances has been defined
- Strategic supplementation of concentrate mixture (@ 1.2 % of the body weight) has been established for better growth and meat quality of Barbari goats reared for field conditions
- Supplementation of area specific mineral mixture resulted in better dressing percentage and meat quality in Barbari kids under intensive goat rearing system
- Identified anti-methanogenic feed resources for goat production system
- Developed highest bio-mass producing fodder system (Guar+ Lobia + Sunhamp) for goats under rain fed conditions
- Developed *Morus alba* based cost-effective agro-forestry system has sustainable goat husbandry in semi-arid and rain fed areas
- Fatty acids and mineral status of milk of different Indian goat breeds has been determined
- Low cost-protein and mineral enriched value added goat meat products has been developed using fresh goat spleen
- Developed herb supplemented functional goat meat and milk products and extracts to prepare emulsion based functional goat meat products
- Goat milk fat was used as fat substitute in emulsified goat meat products
- Standardized process for preparation of *herbal* functional milk, whey drinks, goat milk and meat based biscuits, and low fat cheese
- Created database on goat diseases including parasitic conditions for different states of the country
- Developed package of practices and dynamic health calendar for goat farmers
- Basic information on goat production systems, marketing and ITK has been collected and analyzed
- Created baseline data on commercial goat farming and its economics

- Organized National and International training programmes on goat rearing and related areas.

Technologies Developed/ Commercialized

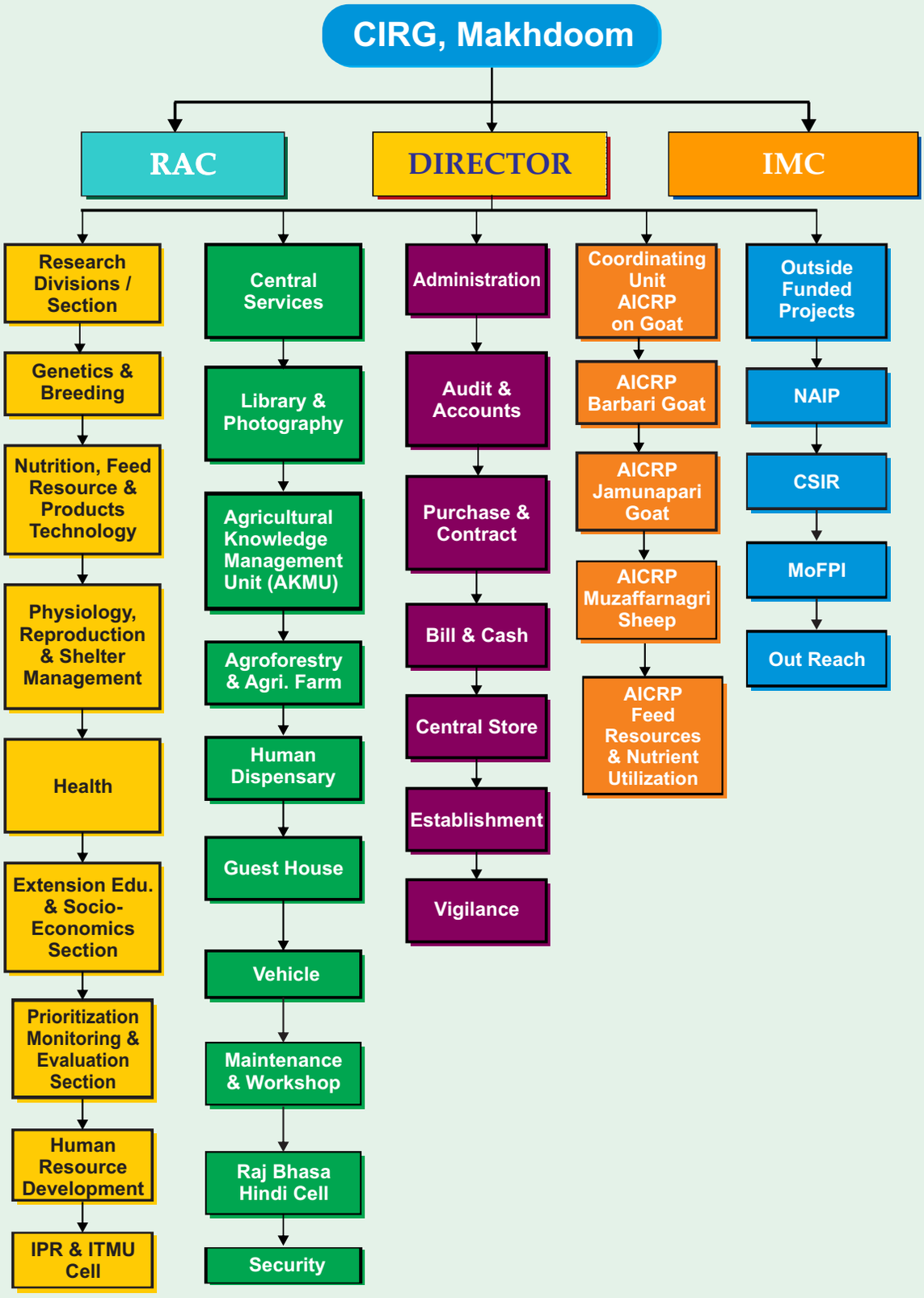
Following farmers friendly technologies were developed by the institute during the XI Plan

- Intra vaginal pessaries for oestrus synchronization.
- Modern goat appliances to reduce feed and water wastage
- Area specific mineral mixture
- Low cost complete feed palletes
- Cost-effective milk replacers for kids
- Goat meat *Murukku:* A crispy food product
- Goat meat *Nimkee:* A snack food
- Goat milk Shrikhand
- Goat milk based moisturizer soap (Ajas)
- BRUCHEK-Dot ELISA Kit to diagnose Brucellosis in goats
- ELISA Kit to Diagnosis of Johne's Disease
- Inactivated Johne's disease vaccine
- ALQUIT- Ectoparasiticidal Drug for animals (commercialized)
- Novel herbal antidiarrhoel drug for animals
- Herbal anti-coccidial drug- Herbicox for goats
- Anti-bacterial herbal formulations for animals

Impact of Research

- Improved productivity and genetic potential of indigenous goats through supply of superior germ plasm **(2156 improved bucks and does during the XI Plan)** from institute units to State Animal Husbandry Department, other developmental agencies and individual farmers
- Imparted training to farmers, professionals and other entrepreneurs **(1512)** on scientific goat rearing and entrepreneurship, resulting in establishment of over 500 small-large commercial goat farms in different parts of the country
- Extended capacity building programme to 84 stakeholders including veterinary officers/ livestock development officers and banking personnel's
- Improved body weights of Jamunapari (45.67%) and Barbari (31.96%) goats at 12 month age
- Improved kidding rate (1.4 in Jamunapari and 1.48 Barbari) and milk production performance in Jakhrana (27% does above 2 liter during peak yield)
- Created semen bank for important goat breeds and standardized technique for successful AI in experimental goat flock. The technology is being perfected for its implementation at farmers flock
- Development of suitable milk replacer for pre weaning kids. The technology has been adopted by several goat keepers.
- Developed complete pelleted feed, feed blocks for goats including designing of low cost pelleting machine that is being adopted by commercial goat farmers for intensive goat rearing
- Development of goat health calendar leading to over-all reduction in mortality at CIRG goat farms and elsewhere in the country
- Developed farmers' friendly cost-effective technologies for diagnosis of brucellosis and JD in goats, which will be highly effective in checking mortality in goats under field conditions
- Commercialized ectoparasiticidal herbal drug technology-Alquit

ORGANIZATIONAL SETUP



STAFF POSITION

Category	No. of post sanctioned	No. of post filled
RMP	1	**1**
Scientific	50	**38**
Administrative	36	**34**
Technical	72	**71**
Supporting	104	**93**

FINANCIAL STATEMENT (2011-12)

	Plan (Rs.lakh)		Non Plan (Rs.lakh)	
	Allocation	Expenditure	Allocation	Expenditure
A. Recurring				
Establishment charges	0.00	0	1120	**1103.04**
Wages	0.00	0	387.05	**182.03**
OTA	0.00	0	2.00	**1.19**
TA	10.00	10.00	3.50	**3.37**
Other charges	132.00	131.99	271.95	**250.84**
HRD	2.00	2.00	0	**0**
Total	144.00	143.99	1784.50	**1540.47**
B. Non recurring				
Equipments	73.90	73.84	13.50	**13.5**
Furniture	6.15	1.50	1.50	**1.50**
Library books & Journals	15.05	15.04	2.50	**2.49**
Livestock	0.00	0	0	**0**
Work	185.90	185.20	0	**0**
Land Development	0.00	0	0	**0**
Total	281.00	280.23	17.50	**17.49**
Grand Total (A+B)	**425.00**	**424.22**	**1802.00**	**1557.96**

GOAT GENETICS AND BREEDING DIVISION

GGB-1.09 : Improvement and sire evaluation of Jamunapari goats for milk production

R. Roy (Nov, 2011), P.K. Rout, Gopal Dass and H.A. Tiwari

Geographical area consisting of ravines of Yamuna, Chambal and Kawari rivers of Chakarnagar , Etawah of UP and adjoining area of Bhind and Morena districts of M.P. is the native tract of Jamunapari breed of goats. At CIRG Jamunapari goats are maintained under semi-intensive management system and are housed separately according to age, sex and physiological status viz., pregnant, lactating and dry. They remain on browsing for 6-7 hrs daily and receive supplementation with concentrate. Dry fodder, mainly gram and pegion-pea bhoosa and seasonally available fodders are also provided as per requirement. Generally grazing materials are in abundance from July to September . During lean period, tree loppings are provided. The newly born kids are kept with dams in kidding sheds for 5-6 days. The kids are fed with colostrumafter the birth. Tree leaves are provided for nibbling and creep mixture is offered to them *ad lib*after 15 days of age. Clean drinking water is also provided in the corrals.

Opening and closing balance of the flock were 735 and 758, respectively. The population growth of the flocks was 100.80% .The overall mortality of the flock during the year 2011-12 was 3.62% which was significantly lower than previous year in different age groups.

Production Performance

The mean body weights of kids at birth, 3, 6, 9 and 12 months of age during the year 2011-12 were 3.07±0.06, 10.79±0.41, 14.58±0.52, 17.29±0.63 and 24.38±0.69 kg, respectively. Male kids recorded higher growth rate during different age groups. Single born kids showed significantly higher weights than those born as twins or triplets.

Least squares means of part lactation milk yield in 90 days and 140 days were 88.04±3.53 and 131.99±11.64 liters, respectively. Season of kidding had significant (P<0.01) influence on both the milk yields. The total milk production during this year was significantly higher than that in the previous years.

Reproductive performance of Jamunapari goats in terms of tupping percentage and breeding efficiency on the basis of does tupped were 83.33% and 94.59%, respectively. The kidding rate was 1.38. During the year, 370 kids were born, out of which single born kids were 61.11%, twins 37.3% and triplets were 1.58%.

Feedlot Performance

A total of 21 randomly selected male kids at 3 month of age were kept under feedlot system where they were offered the concentrate, green and dry fodder *ad libitum*. The overall mean body weight of these kids was 18.09, 28.35 and 37.33 kg, respectively at 6, 9 and 12 month of age with the average daily weight gain (ADG) of 114.0 g/d and 99.7g/d during 6-9 and 9-12 age groups. Feedlot study indicated that breed has tremendous genetic potential, which have been improved through selection for future exploitation.

Genetic parameters for body weights at various stages of growth and milk production traits were estimated. The heritability estimates for body weights at birth, 3, 6, 9 and 12 month age were 0.19±0.05, 0.22±0.06, 0.51±0.11, 0.35±0.09 and 0.29±0.09, respectively. The genetic trends for the body weight at birth, 3, 6, 9 and 12 month age were 0.12±0.03, 0.59±0.12, 1.58±0.19, 2.66±0.28 and 2.14±0.36 kg, respectively. The heritability estimates for 90 day and 140 day were 0.39±0.10 and 0.34±0.10.The h^2 estimates for milk yield traits were moderate. It is suggested that selection of breeding individuals on the basis of body weight at 6 month and 90 days milk yield may be practiced for improvement.

Sire Evaluation

Ranking of sires was done on the basis of breeding value estimates obtained as BLUP method. The top ten bucks were utilized for producing next generation progeny.

Supply of elite germplasm

Elite breeding animals were supplied to various developmental agencies, Research Organizations, Non-Government Organizations and progressive farmers for genetic improvement of their flocks under field conditions.

Table 1 : Milk yield performance of Jamunapari goats from 2009-2011

Year	90 days milk yield (90DMY)(in litre)		140 days milk yield (140DMY)(in litre)	
	No.	Mean	No.	Mean
2009	81	62.086±3.256	81	85.079±4.631
2010	121	80.259±3.423	122	108.873±4.924
2011	251	88.041±3.539	136	131.990±11.649

GGB1.10 : Genetic improvement of Barbari goats for meat and milk production

S. K. Singh, Shivsharanappa (up to November, 2011), Nitika Sharma

Barbari is an important dual purpose , medium size goat breed, adaptable over varied agroclimatic conditions. This is one of the best suitable breed for stall feeding due to high kidding rate and better weight gain alongwith early sexual maturity. Long term genetic improvement programme for meat and milk was continued in Barbari goats at institutional farm . There were 873 Barbari goats available as on 1.4.2011, (305 doe and 91 bucks) and 459 kids (226 female and 233 male) were born at the farm during the year (2011-2012). The population growth was 138% with survival rate of nearly 96 % . The average mortality was 4.4% which was one amongst lowest at this farm. Closing balance at the end of year was 776 animals.

Data on adult body weight at birth, 3, 6, 9 and 12 months of age from year 2007 to 2011 were analysed using mix-model equations through SAS software and presented in Table 1. The fixed effects included in the analysis were year , season and type of birth and sex of kids. The overall mean body weight at birth, 3, 6, 9 and 12 months of ages was 1.87±0.01, 7.89±0.04, 11.57±0.05, 15.43±0.14 and 19.50±0.16 kg, respectively. The respective body weights of 2010-11 born kids completing performance in the year under report were 1.85±0.02, 7.65±0.08, 11.18±0.18, 15.76±0.25 and 18.49±0.34 kg respectively. Single born kids were heavier than twins or triplets up to 12 months of age.

The lactation performance for milk yield over 90, 140 days and Lactation Milk Yield (LMY) were also analysed using mix-model equations by SAS software. Factors included in statistical analysis model were year, season of kidding and parity of dam. The mean lactation length (LL) was 114.10±0.79 day and the mean milk yield for 90 days, 140days and LMY was 55.28±0.22, 74.45±2.39 and 54.72±0.27 liters, respectively. Does kidded during March -April season produced significantly higher quantity of milk than those kidded during October-November season. The order of kidding (Parity of dam) did influence lactational traits significantly. Highest milk production were observed during 4th to 6th parities.

The mean age at first mating ranged between 227±7 and 291±8 days while weight at first mating ranged between 14.5±1 and 21±1 kg. The mean kidding interval over years had a range of 217±6 to 237±7 days. The variation in the mean of reproductive traits indicated environmental influence on these traits. The breeding efficiency on the basis of available does was 102% and on the basis of does tupped was 85% during the year 2011-12. Out of 298 kidding observed, 141 were single, 153 twins and 4 triplets. Kidding rate was 1.54.

Three hundred and sixty six superior does and bucks were distributed for grading up, conservation and genetic improvement of farmers flock, to state government and other developmental agencies.

Table 1: Least Squares Mean of Body Weight Growth (Kg) in Barbari Goats

Factor	Weight at				
	Birth	3M	6M	9M	12M
Overall mean	1.87±0.01 (2507)	7.89±0.04 (2269)	11.57±0.05 (1801)	15.43±0.14 (1453)	19.50±0.16 (1134)
Year of birth					
2007	1.79±0.01 (636)	8.45±0.08 (567)	12.82±0.12 (538)	16.27±0.17 (469)	21.01±0.20 (415)
2008	1.78±0.02 (413)	7.21±0.10(306)	10.64±0.17 (252)	14.13±0.28 (120)	15.93±0.41 (68)
2009	1.82±0.01 (503)	7.21±0.08 (474)	10.65±0.12 (447)	14.11±0.19 (339)	18.79±0.26 (223)
2010	1.71±0.02 (378)	7.57±0.09 (367)	10.49±0.15 (359)	15.10±0.20 (340)	19.28±0.24 (288)
2011	1.85±0.02 (577)	7.65±0.08 (555)	11.18±0.18 (213)	15.76±0.25 (185)	18.49±0.34 (120)
Season of birth					
I	1.82±0.01 (1183)	7.59±0.07 (1016)	10.90±0.10 (910)	14.45±0.16 (729)	19.65±0.20 (467)
II	1.75±0.01 (1324)	7.65±0.06 (1253)	11.41±0.11 (891)	15.70±0.17 (724)	17.75±0.22 (647)
Sex of kid					
Male	1.88±0.01 (1262)	8.03±0.06 (1139)	11.86±0.10 (889)	16.26±0.16 (679)	20.26±0.20 (523)
Female	1.70±0.01 (1245)	7.20±0.07 (1138)	10.45±0.11 (912)	13.90±0.16 (774)	17.14±0.19 (591)
Type of birth					
Single	2.09±0.01 (834)	8.98±0.07 (761)	12.25±0.11 (614)	16.06±0.16 (477)	19.49±0.20 (360)
Twin	1.82±0.01 (1527)	7.39±0.05 (1381)	11.14±0.08 (1079)	15.09±0.12 (899)	18.80±0.15 (691)
Triplet	1.45±0.03 (146)	6.49±0.14 (127)	10.09±0.23 (108)	14.07±0.35 (77)	17.81±0.42 (63)
***P<0.01, *P<0.05*					

GGB 1.12: Improvement of Jakhrana breed of goat (*Capra hircus*) for milk and meat production under farm and field conditions

Saket Bhusan, U. B. Chaudhary, Gopal Dass, A. K. Mishra

Jakhrana is a valuable milch breed and also used for meat due to its compact and large body size. The coat colour of the breed is black with white speckles on the ears. The breed derives its name from its native tract village "Jakhrana". At CIRG, Makhdoom Jakhrana goats are maintained for genetic improvement for milk and meat production. These animals are maintained under semi intensive system of feeding management where they allowed grazing 7 to 8 hours on natural pasture with supplementation of some amount of concentrate depending upon the status and age category of the animals. Animals were kept separately according to their reproductive and productive status. Three to four times milk was provided to the kids after birth to 15 days of age. After 15 days of age kids were provided only two times milk in the morning and evening. Selective breeding was practiced in the flock. Five to ten percent animals are culled from the flock on the ground of health, low milk production and body weight. Bucks are selected on the basis of 9 months body weight and does

are selected on the basis of 90 days milk yield. Kids are weighted 15- day's interval from birth to weaning and thereafter at monthly interval up to 12 months of age. Weaning of kids is generally done at 3 months of age. Animals are vaccinated against all important diseases like PPR, enterotoxnemia and FMD.

Kidding and reproduction traits

During the year 2011 -12, 119 kids comprising 59 male (49.57 %) and 60 female (50.42 %) born from 83 does . Of these does , 49 (59.03 %) gave single birth, 32 (38.55 %) produced twins and 2 (2.40 %) gave triplet births. The kidding rate was 1.43. Gestation period, kidding interval and dry period of Jakhrana goats were 152.47±0.52, 289.23 ±0.78 and 142.64±0.57 days,respectively.

Production performance of Jakhrana

Least squares means for body weight at birth, 3, 6, 9 and 12 month weight and milk production for 30, 60, 90, 120 days production are presented in the table. The average body weight at 9 and 12 months body weight of Jakhrana kids increased by 24.96 % and 30.53 %, respectively as compared to 2010-11 than 2009-10. Increasing trend of body weight was also observed at 3 and 6 month of age in kids of 20011-12 than 2010-11 as 31.43 % and 30.47 %, respectively. Females were selected on the basis of 90 days milk production resulting in significantly effect on milk yield of 30, 60, 90, 120 and 150 days. The milk yield of 30, 60, 90, 120 and 150 days of does increased 26.85 %, 25.95 %, 28.63 %, 44.47 %, and 53.57 %, respectively from 2011-12 than 2009-10. Average lactation length of Jakhrana goats was 158.35±4.05 days and average lactation production was 181.82±7.31 liter. Average per day milk production of Jakhrana goats was 1.15 liter up to 150 days. Lowest lactation length was 77 days and highest lactation length was 259 days (Table 1).

Forty nine breeding males were supplied to the farmers, government and non-government agencies for genetic improvement .

Table 1: Least Squares Mean of Body Weight Growth (Kg) of kids and milk production (liter) of Jakhrana does

Year	Birth	3M	6M	9M	12M
Least Square Means of Body Weight					
2009-10	2.76±0.44(123)	7.68±0.13(108)	10.37±0.21(88)	14.34±0.36(58)	19.55±055(42)
2010-11	2.58±0.03(89)	10.00±0.22(80)	13.53±0.30(75)	17.92±0.43(64)	25.52±0.92(25)
2011-12	2.71±0.38(115)	9.29±0.16(55)	14.40±0.27(27)	-	-
Least Squares Means of Milk Production					
Year	**30 d**	**60 d**	**90 d**	**120 d**	150 d
2009-10	37.02±1.17(83)	72.20±2.70(83)	98.0±3.9.(73)	114.76±4.32(70)	125.034±5.77(67)
2010-11	38.63±1.831(34)	74.87±3.81(34)	105.68±6.68 (31)	132.32±7.32(27)	159.63±10.37(23)
2011-12	46.96±1.690(69)	90.94±3.13(66)	126.06±4.59 (59)	165.80±5.479(50)	192.01±8.07(26)
***P<0.01, *P<0.05*					

GGB 2.01 : Molecular analysis of major genes and quantitative trait loci influencing growth, reproduction and disease resistance traits in Indian goats

P.K. Rout, S.K. Singh and R.Roy (upto November, 2011)

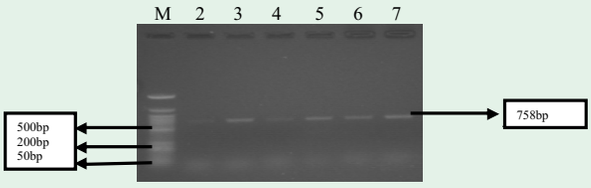
The major focus of this project is to identify and characterize genetic variation underlying economically important traits in Indian goats. During the domestication, the goat has undergone intense natural selection pressure for various phenotypes. Selection in this species has led to distinct phenotypes associated with meat, milk, fibre production thriving in tropical environments in some part and tolerating specific pathogens. These selective pressures have differentiated sub-populations and produced phenotypes according to the need of the region. Therefore, it is necessary to utilize molecular markers to select high performance individuals for suitable environment for enhancing productivity and sustainability in goat production. It is necessary to combine molecular markers and production traits in an efficient manner for attaining higher productivity. DNA marker information, which identifies important allelic variation within the genome, could be incorporated into genetic evaluations to provide producers with selection tools that increase the rate of genetic improvement for lowly heritable traits. The objective was to identify genetic variation in major genes that influence growth, fecundity, and disease resistance traits.

Characterization of Calpastatin (CAST) gene in goats

The most important component of the calpain system with respect to meat tenderization is calpastatin. The calpastatin gene plays an important role in formation of muscles degradation and tenderness after slaughter. In skeletal muscle cytoplasm there are enzymes that are responsible for post mortem proteolysis during cold storage of meat. This process is mostly influenced by the ì- calpain (CAPN1) and m-calpain (CAPN2), encoded by the CAPN1 and CAPN2 genes, respectively. Calpastatin (CAST) is an endogenous calpain specific inhibitor, encoded by the CAST gene, inhibiting the calpain activity in tissues post mortem, and thus regulating the rate and extent of tenderness of meat. Genetic variation was analysed in goat

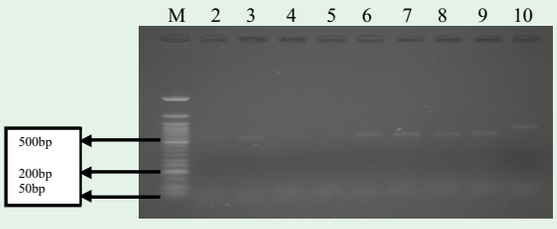
calpastatin gene in Sirohi (30), Jamunapari (30), Jakharana (20) and Barbari (27) goat breeds.

The amplified product was observed as 758bp(Fig 1). Polymorphic pattern was analysed by PCR-RFLP with Alu1 enzyme. PCR-RFLP genotyping showed one pattern in all the individuals indicating the CC genotype in all the breed. The allelic combinations 558+200bp was observed in all the analysed samples in all the breeds (Fig 2). Calpastatin gene has been used as candidate genes for meat quality in sheep and cattle. However the present study did not show any variation between individuals in Calpastatin gene, which suggests further targeting regulatory region for establishing breed variation and association with meat quality traits. Association of Pit 1 gene polymorphism with milk yield at 90 days in Barbari goat has been established.



PCR amplification of CAST gene in Indian goats.
(Lane 1: 50 bp Marker, Lane 2-7: PCR products)

Figure 1 : PCR amplification of CAST gene in Indian goats with 50 bp marker



(Lane 1: 50 bp Marker, Lane 2-9: RFLP products and Lane 10: PCR product)

Figure 2 : Alu1 RFLP genotyping of CAST gene in different goats

GGB 2.10 : Genetic evaluation and improvement in Muzaffarnagari sheep for body weight and wool yield

Gopal Dass, Souvik Paul, S.D. Kharche and V. Rajkumar

Muzaffarnagari, an excellent mutton producing sheep breed of the country. The breed is native to Muzaffarnagar and its adjoining districts of Western Uttar Pradesh viz. Meerut, Saharanpur and Bijnor. The breed is mainly reared for mutton and wool production. This breed is known for its growth and better adaptability than other Indian sheep breeds. Pure bred flock of Muzaffarnagari sheep is being maintained under a "Network Project on Sheep improvement" since 1976. Presently efforts are being made to improve the breed for higher muttonproduction through selective breeding.

Management of flocks

Flocks were maintained under semi-intensive system of feeding management with 6-7 hours grazing supplemented with 100-500 gm concentrate in various physiological stages and age groups of the animals. Dry and green fodder was also offered as per the requirement. Controlled breeding was practiced to improve the managemental efficiency. Ewes were bred during May-June and October-November followed by lambing in the months of October–November and March-April, respectively. The lambs were weaned at 2 months of age due to poor milk production as

Muzaffarnagri sheep with triplets

Particular	Birth	3M	6M	9M	12M
Overall mean	13.64±0.03 (608)	15.32±0.16 (523)	21.09±0.21 (369)	25.42±0.23 (333)	30.42±0.26 (271)
Sex	**	**	**	**	**
Male	3.71±0.04 (313)	15.78±0.21 (273)	22.54±0.30 (187)	27.85±0.33 (158)	33.32±0.39 (119)
Female	3.58±0.04 (295)	14.68±0.23 (250)	19.63±0.30 (182)	22.99±0.31 (175)	27.53±0.34 (152)
Year	**	**	NS	**	**
2009	3.56±0.05 (132)	15.15±0.31 (125)	20.49±0.37 (121)	24.02±0.42 (96)	28.73±0.47 (94)
2010	3.53±0.05 (146)	13.63±0.30 (135)	21.15±0.36 (128)	25.71±0.37 (122)	30.91±0.41 (104)
2011	3.72±0.04 (267)	16.92±0.21 (263)	21.63±0.38 (120)	26.52±0.38 (115)	31.63±0.49 (73)
2012	3.78±0.08 (63)	-	-	-	-

well short lactation period of their dams. Regular treatment and strict prophylactic measures were practiced for vaccination against Enterotoxaemia, Foot and Mouth Disease, Sheep Pox, H.S., PPR etc. De-worming with different anthelmintic was practiced at pre-monsoon and post monsoon seasons and as and when required. Dipping was done after 15-20 days of each shearing.

Production Performance

The opening balance of 536 Muzaffarnagari sheep comprised of 150 males and 386 females. During the year 84 elite germ plasm was distributed to various Government and other developmental agencies for field improvement programmes.The overall mortality of the flock during the year was 2.64%.

The overall least-squares means of body weights of lambs at birth, 3, 6, 9 and 12 month age were 3.72±0.04, 16.92?0.21, 21.63±0.38, 26.52±0.38 and 31.63±0.49 kg, respectively during the year under report. The annual wool production was recorded to be 1370gm, which was 250 gm higher than previous year.

Similar to body weights and wool production, the improvement in reproduction traits was also observed. Annual tupping, lambing on ewes available basis and lambing on ewes bred basis were 103.0, 91.0 and 88.2.2%, respectively. Twinning was recorded as 11.8%, which was increasing over the years. The improvement in twining rate was due to extensive use of rams having records of twins and triplet. The lambing with triplet lambs for second time was also observed during this year. The replacement rate of the ewes was 30.4%

Performance in field

Surveys were conducted during years 2008-2010 to record the management practices and growth performance of Muzaffarnagari sheep in field conditions. The flocks were maintained on extensive production system in which animals were grazed for 6-8 hours on the common grazing land or on the road and canal sides with zero supplementary feeding. The animals were taken for grazing at 10.00-11.00 AM and returned from grazing with sunset.

The mean body weights of lambs under field conditions were recorded as 2.83, 11.93, 19.45, 22.86 and 25.63 kg respectively at birth, 3, 6, 9 and 12 month of age. On comparison, it was observed that the performance under field was 0.780, 5.780, 2.00, 1.990 and 3.210 kg. lower than farm animals at respective age. These results suggest that more number of breeding rams produced at farm should be utilized under field for overall improvement of farmer's flocks.

NAIP Project: Goat husbandry based integrated approach for livelihood security in disadvantaged districts of Bundelkhand region

M.K. Singh, A.K. Goel, A.K. Dixit, R.B. Sharma, S.V. Singh, Deepak Sharma (up to January 2012) Sanjeev Kumar wef: February 2012, A.K. Roy, Hritik Biswas

Four hundred forty six females of Sirohi and Jakhrana breeds were provided to 135 resources poor project beneficiaries belonging to 9 adopted villages of Hamirpur and Mahoba districts. Seventy one kids were born from 49 kidding up to March, 2012.

Twenty five bucks of Jakhrana and 13 bucks of Sirohi breed were distributed to 37 Goat keepers of 15 villages to upgrade the low potential and non-descript goats of this region.

Income of rupees 8915.00 per household/year obtained by a goat unit (5 females). Above estimated income was calculated with the assumption of 15% mortality of goat and 50% multiple birth rates. Income obtained by sale of kids at 9 month @ Rs. 2500, sale of 25% milk @ Rs. 15/liter and sale of 20% manure produced @ Rs. 1000/ ton. One unit of goat also provided 160-180 days employment/household/year.

Prophylactic & curative measures provided additional income of Rs. 2114/household/Year by increasing survivability of goat, cow and buffaloes. 3720 goats were vaccinated for PPR, ET, FMD, HS and dewormed against internal and external parasite. 1525 cattle and 840 buffaloes were vaccinated for HS, FMD and Black quarter and dewormed for internal

parasites. 244 animals were provided treatment for different diseases. These measures resulted in decrease of goat mortality from 34% (2009-10) to 11% (2011-12) and bovine mortality from 9.6 (2009-10) to 5.1% (2011-12). The body weight of kids increased from 14.6 (2009) to 18.4 Kg at the age of 12 months (2011), resulting increase of income of Rs. 600/kid.

Improved verities of fodder crops (Berssem, Oat, Bajara, Sorghum)/horti-silvipasture/ cultivation of grasses in the form of FLD were introduced at 55 farmer's field in eleven adopted villages. These measures resulted in increase of fodder yield by 50% over prevailing varieties. An increase in fodder yield also increases milk yield of bovine, which increases income of Rs. 2720/ household/lactation. 240 beneficiaries adopted improved verities of fodder crops.

Soil samples of 40 farmers of 8 adopted villages of Mahoba district were analyzed and recommendations provided for judicious and appropriate utilization of fertilizer.

120 night shelter were made in 4 villages for assuring better growth and survivability. About 75% expenditure on night shelter was borne by the beneficiaries. Units of 25 birds of Nirbhik strain (>6 week old) were provided to 22 beneficiaries in Sudamapuri village of Mahoba district. About 39% beneficiaries have adopted backyard poultry as an additional source of their family income. The birds provided an income of Rs. 3120 /-/household/year.

Major interventions introduced under project (goat, fodder, poultry) have together provided additional income of Rs. 16872/hh/y or Rs. 1406/month (37%) over base line income of Rs. 3754/hh/y (2010-11).

Other interventions included Front Line Demonstrations (FLD) such as improved varieties of seed of pulse and oilseeds crops, integrated insect-pest management, feed pellet to goats (45 beneficiaries in 2 adopted villages) which resulted in increased income of Rs. 1600/house hold/year *i.e.* by 23% increase in crop yield and 12 % increase in body weight of kids (goat).

Data collected from 210 households of 16 adopted villages on villagers' sources of income, employment status, prevalent crop and livestock management practices, cropping intensity, biomass for livestock, irrigation resources, efficiency of irrigation resources, awareness and adoption of technologies, production performance, major constraints, marketing channels for livestock and crops.

Poor households of both adopted districts were motivated to integrate and pool their resources for setting up commercial goat farm. Fifty poor households (both from adopted and non-adopted villages) have started a goat cooperative farm initially with 250 goat. Another three goat farms have also been initiated in this region. Such endeavor is expected to create a favorable environment for linking goat farmers with the market.

Eleven trainings on different interventions of Project were conducted by involving 20-30 people from each adopted villages. Besides trainings, 34 farmer's day and field days, 37 demonstrations on Paneer making were conducted to made aware farmers about the advantage of adopting low cost interventions and value addition of their products.

Seven goat farming based self help groups were formed in 11 adopted villages during 2011-12. Each group has 12-15 members and most of them were women.

Seventeen goat shelters were upgraded (major resource provided by farmers) for better production and to popularize proper housing of goats.

Five training manuals, eight news paper clippings and two video films were developed/disseminated under this project. More than Rs. 2.50 lakhs revenue was generated with the village based self help groups.

Environment and Social frameworks were implemented in adopted villages to reduce green house gases by encouraging supplementary concentrate feeding, plantation of fruit and fodder producing trees, conducting FLD on integrated insect-pest management, promoting organic manure and judicious use of fertilizers, increasing cohesiveness among villagers by forming self help groups, farmers groups with active participation of women.

NAIP: Bioprospecting of genes and allele mining for abiotic stress tolerance

P.K. Rout, S.K. Jindal and N. Ramachandran

Establishing the physiological indicators for heat stress in semiarid region

Heat stress affects animal bioenergetics, and has negative impact on animal performance and well-being. The objective was to assess the heat tolerance of goats in semi arid region by analyzing physiological response in different environmental condition. The investigation has been carried out in Jakhrana, Sirohi, Jamunapari and Barbari goats. The dynamic physiological response of goats such as core body temperature (RT), respiration rate (RR) and heart rate (HR) was evaluated in different environmental conditions during hot dry period (May-June), comfortable period (November) and cool dry period (December-January). Study included three large size breeds and one medium size breed. Similarly contrasting coat colour was included such as Jamunapari (white colour), Jakhrana (black colour) Sirohi (brown colour) and Barbari (dark brown spotted) in the study. The physiological response of goat has been recorded in different environmental condition with respect to different growth stage. Physiological database for different breeds has been developed.

Identification of heat stress tolerant and susceptible phenotype

It was also observed that respiration rate and heart rate can be used as stress indicator for identifying genotypes. Two contrasting genotype i.e. low stress susceptible genotype and high stress susceptible genotype were identified. Least square analysis was carried out to observe the factors such as breed, age group and genotype affecting the biomarkers in three different goat breeds. Genotype had significant effect on biomarker.

Characterization of candidate genes in heat stress regulation pathways with adaptive significance in goats

Sequencing of MC1R, Tyr, AP2 binding Hsp70.1, Hsp7 and Hsp9 and STAT5A was carried out in 20 heat stress susceptible and heat stress tolerant genotype.

22 different haplotype sequences of Tyr, Hsp70.1, Hsp9 and STAT5A were submitted to NCBI.

Sequence analysis of HSP70 gene revealed SNP at 83 position(Thymine replaced by adenine) and at 531 – Gap.

Sequence analysis of MC1R gene showed two SNP .First SNP observed at position 40 i.e -/G(indel replaced by guanine) and second SNP at position 62 A/C i.e transversion purine replaced by pyrimidine) and it was in noncoding region.

No significant sequence variation was observed in HSP 90 gene.

Genotyping of hsp 70.1 (exon1) gene by HRM approach

High Resolution Melting (HRM) is a refinement of well-established DNA dissociation or melting techniques to determine the Tm of a DNA hybrid. The genotyping by HRM analysis showed four different genotypes in the analysed samples.

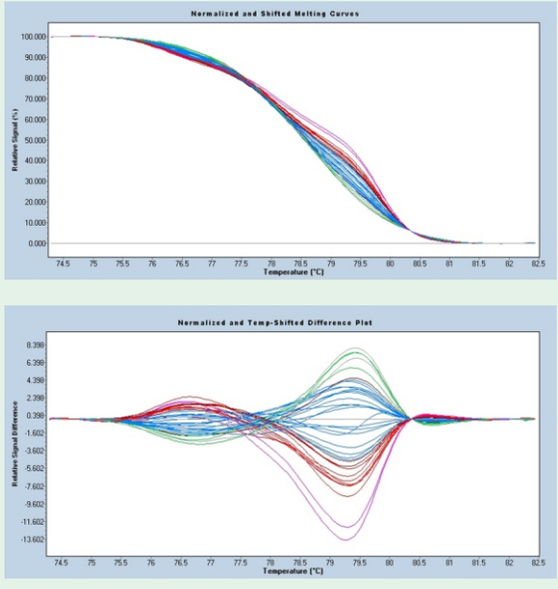
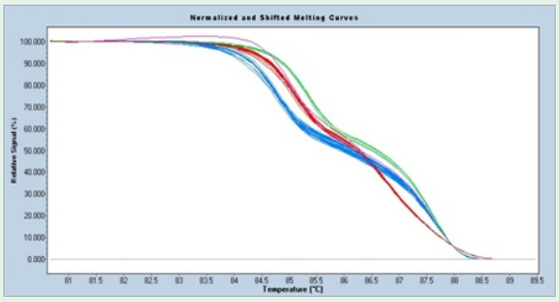


Fig: Genotyping of hsp70.1 (exon1) gene showing four different groups

Genotyping Tyr exon 5 by HRM analysis

Coat color is a trait that is easily observable and distinguish individuals, strains and breeds in mammalian species. Mammalian pigmentation is controlled by the action of TYR, TYRP1 and DCT in producing eumelanin and phaeomelanin in melanocytes. Genotyping by HRM analysis showed 3 different genotypes in all the analysed samples in different breeds.



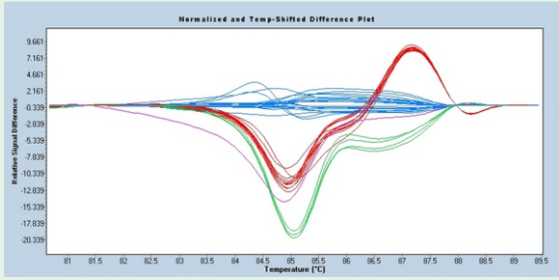


Figure 1 & 2: Genotyping of tyr (exon 5) gene showing 3 different groups and one unknown sample

Record production performance and supply of superior germplasm by CIRG

During the period 2011-12, CIRG set a record in total milk production in a year from its goat flocks. This increase in total milk was achieved almost from the same population of does as was in the previous years. Proper health, lower kid mortality, improved management and better nutritional interventions were responsible for this achievement. Also, during the period under report record numbers of superior animals were supplied by the institute to individual farmers, state government and other agencies for breed improvement. Revenue generation through sale of animals and animal products was also highest during 2011-12.

Year	No. of kiddings	No. of elite animals supplied	Milk production (L)
2002-03	443	410	23333
2003-04	504	499	20445
2004-05	456	363	25019
2005-06	478	521	19628
2006-07	565	414	22942
2007-08	536	232	35665
2008-09	576	338	25446
2009-10	493	392	22638
2010-11	663	374	29181
2011-12	**651**	**689**	**40907**

PHYSIOLOGY, REPRODUCTION AND SHELTER MANAGEMENT DIVISION

XI/PRSM - 1.01: Studies on refinement of frozen semen technology and strengthening of goat semen bank

S.K. Jindal, A.K. Goel, S.D. Kharche, N. Ramachandran, R. Priyadharshini and Satish Kumar (w.e.f. 13.12.2011)

Strengthening the semen bank

Elite bucks of four goat breeds viz. Barbari, Jamunapari, Jakhrana and Sirohi with good freezability were selected and semen was collected from each buck routinely twice a week . Cryopreservation of semen of three breeds of goats was carried out. A total of 1636 doses (Sirohi- 307, Barbari- 459, Jakhrana- 870) of good quality semen straws were preserved.

Frozen semen artificial insemination in Sirohi and Barbari goats

Artificial insemination (AI) is a powerful tool to adapt production to meet market demands through its formidable ability to produce many progeny per male in multiple environments over time. Though AI in goats was introduced long since, its wide spread usage had been relatively limited. An experiment was conducted to study the conception rate using frozen semen AI in the pluriparous Sirohi (n=30) and Barbari (n=22) does available in the experimental shed of Central Institute for Research on Goats in Mathura (27º N latitude, 78º N E longitude on 176 metres above the sea level). Semen collection was done twice weekly using an artificial vagina and cryopreservation of semen was carried out using a Tris based extender with 10% egg yolk and 6% glycerol by conventional method of freezing. Regular heat detection using an apronized buck was carried out during the months of May, June and July. At the time of AI the straws were thawed in 40ºC water bath for 15sec and cervical insemination was done using the frozen-thawed semen straws having approximately 50 x 10^6 cells/dose. The conception rate during first and second service was higher in Barbari breed than the Sirohi, but the Chi square analysis revealed that the difference was not statistically significant. This may be because of the higher ovulation and prolificacy rate in Barbari than Sirohi. The conception rate at first and second estrum was higher whereas animals inseminated from third to fourth estrum did not conceive. The conception rate of AI using frozen semen in goat was 23.3% in Sirohi and 25.9% in Barbari breed with an overall conception rate of 24.6%. Out of 14 does (seven each of Barbari and Sirohi breed) pregnant by AI using frozen semen, eight kids were born from seven Barbari goats which include one twin, and six kids were born from Sirohi goat pregnant by AI and one case of fetal resorption was noted. Thirteen out of fourteen kids survived and were normal but one kid was still born. In the next breeding season of the year (Oct-Nov) ten Jakhrana goats were inseminated with frozen semen and three out of them were conceived and three kiddings were reported. The conception rate by AI in Jakhrana goats was 30%. This experiment shows the potential of artificial insemination in goat improvement in future.

Effect of Different Egg Yolk Level on the Cryopreservation Capability of Jakhrana Goat Semen

Cryopreservation of semen has long been seen as a means of benefiting the breeding of animals

of agricultural importance, and has been recognized as contributing to the conservation of endangered and to overcome aspects of male infertility in animals. The composition of extender, suitable cryoprotectants and optimum freezing and thawing rates are important factors for successful semen cryopreservation. Tris based extenders with egg yolk and glycerol has been widely used for freezing buck semen. This study was conducted with an objective of comparing the addition of two levels of egg yolk (10 and 20%) in the semen extender. A total of 20 ejaculates were collected from eight Jakhrana bucks twice daily using an artificial vagina. Each ejaculate was evaluated for progressive motility, plasmalemma integrity (live), functional membrane integrity (HOS) and acrosome integrity before and after freezing. No significant difference was found between 10% and 20% groups in terms of motility and live percentage before freezing. However, HOST differed significantly ($P<0.01$) between 10 and 20% groups (69.4±1.35 and 78.2±1.32 respectively) after four hours of equilibration. In addition, prefreeze intact acrosome percentage between 10% and 20% groups (93.4±0.54 and 91.3±0.69 respectively) also differed significantly ($P<0.01$). After freeze-thawing, there was no significant difference between groups in terms of post thaw motility and live percentage. Further, functional membrane integrity and acrosome intact sperms also differed significantly ($P<0.05$) between the groups. The presence of 10% egg yolk has exerted better functional membrane integrity (60.56±1.31), acrosome intactness (48.0±1.06) than the presence of 20% egg yolk (52.7±1.87 and 32.5±2.59 respectively). The results from this study proves that 10% egg yolk addition is better than 20% egg yolk level as functional membrane integrity and intactness of acrosome are very essential for better fertility.

Zona Free Hamster Ova Penetration Test (ZFHOPT)

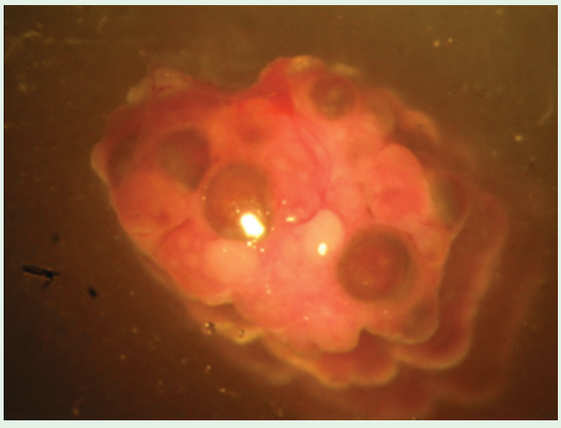
The Zona free Hamster ova penetration Test was done to assess the sperm fertility of buck No. SE 565, SE 571 and SE 576.

In vitro capacitation : A 50 µl of neat semen which possessed a gross motility of +4 or +3.5 was transferred into a centrifuge tube containing 5 ml of BWW medium supplemented with 0.3% BSA. This was subjected to centrifugation at 1000 rpm for 7 minutes after which a clear pellet of spermatozoa were formed. The supernatant was discarded by gentle pipetting without disturbing the semen pellet. The semen pellet was re-suspended into 5 ml of BWW medium and the process of centrifugation was repeated as stated above. The supernatant was again discarded and the pellet was re-suspended in the equal volume of BWW medium. These washings were essential to get rid of seminal plasma, impurities/ contamination of cell debris etc. After a final washing 50µl of the semen pellet was added into 5 ml BWW medium containing 10 µg/ml heparin and 0.8% BSA and kept in a CO_2 incubator for 20 minutes (swim- up). Supernatant collected and centrifuged at 1000 rpm for 7 minutes. The semen pellet was re-suspended in 1 ml BWW medium. Finally sperm concentration was assessed using Neubauer Haemocytometer.

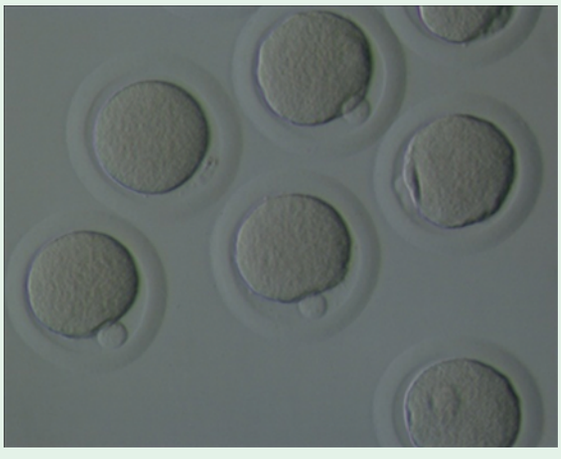
Superovulation of female golden hamster : On the day of mid di-estrus (3rd day of oestrus cycle, 16 hours after the post ovulatory discharge was found in the vagina.), the adult female golden hamsters (7 to 8 weeks of age with 130 – 135 gm body weight) were injected intraperitoneally with 50 I.U. of PMSG (Folligon,Intervet) at 6 am followed 56 hours later by 150 I.U. of hCG (Chorulon, Intervet). The animals were sacrificed 17 hours later and oocytes were recovered.

Collection of oviducts and oocytes : The super-ovulated hamsters were sacrificed by first exposing to chloroform followed by cervical dis-location. Both the oviducts were exposed out by performing laparotomy and kept in a small petri dish containing 2- 5 ml of DPBS with 0.3% BSA. The oviducts were transferred to another petri dish containing BWW with 0.3% BSA and the cumulus mass released by pricking the oviduct with fine forceps in ampullary region under a stereo-zoom microscope.

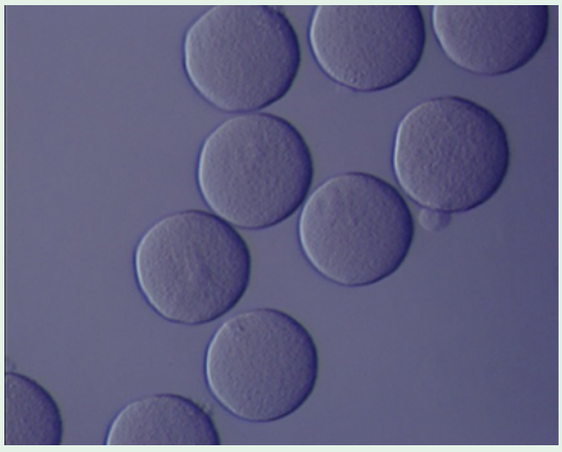
Removal of Cumulus mass : The cumulus mass was treated with 0.1% Hyaluronidase for 5 minutes at 380C in a CO2 incubator. The oocytes were washed twice in BWW medium.



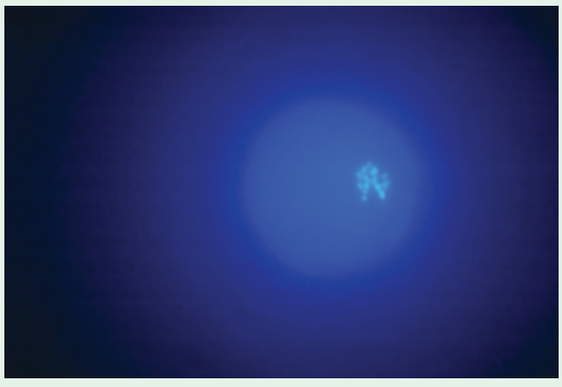
Removal of Zona-pellucida : The cumulus free oocytes were treated with 0.1% Trypsin for 2-3 minutes or till dissolution of zona at 37°C and then they were immediately washed 3 times with BWW medium. The action of trypsin was monitored under a stereo- zoom microscope to avoid over-digestion.

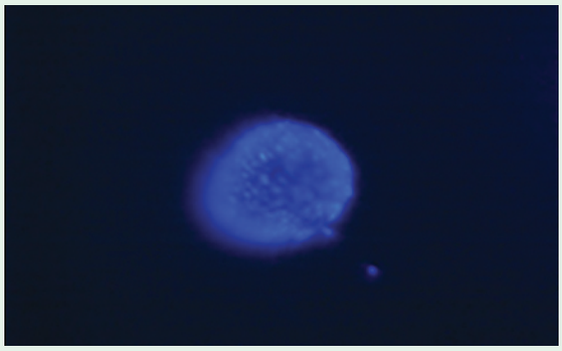


Co-incubation : After capacitation, 100 µl of capacitated sperm drop wasplaced in a sterile disposable petridish. Add 15-20 zona free oocytes to the petridish containing capacitated drop. Layer the semen drop by mineral oil to avoid evaporation. Incubate the petridish at 370C for 3 hrs to allow sperm-oocyte co incubation. At the end of co-incubation, oocyte sperm complexes were washed several times with BWW medium to remove loosely attached spermatozoa.



Sperm penetration assay : After 3 hours of co-incubation (gamete interaction), the zona free oocytes were removed from the incubator to assess the penetration ability of the sperm sample. The oocytes were washed 4-5 times in BWW medium to remove the excess sperms adhered to the oocytes. Oocytes kept in hypotonic KCl solution (50 mg/ml.) Oocytes fixed in 2.5% Gluteryl dehyde for 10 minutes. Oocytes kept in 0.1µg/ml DAPI (4,6-di amino 2-phenyl indole) for 10 minutes. Oocytes kept on micro-slides and observed under fluorescent microscope to count no. of sperms penetrated into the oocytes.





Penetration rate (PR) and Penetration Index (PI) was evaluated by using formula-

$$\text{Penetration rate (PR)} = \frac{\text{Number of oocytes penetrated}}{\text{Number of oocytes inseminated}} \times 100$$

Buck	Penetration rate
SE 571	100%
SE 565	93.33%
SE 576	86.36%

XI/PRSM - 1.02 : Augmentation of prolificacy by using biotechnological tools in goats

S.D. Kharche, A.K. Goel, S.K. Jindal, Satish Kumar (w.e.f. 13.12.2011) and R. Priyadharshini

Preparation of Hormone Delivery System (sponges and injections)

Sponges and injections preparation were standardized in the laboratory. The cylindrical shape sponges with a diameter of 25mm were prepared and tied with one feet long thread. They were washed and autoclaved for sterilization. They were then impregnated with hormone and dried in a oven at 37^{0}C. Similarly, 1ml injection containing hormone was prepared in oil. Thus a total of 250 sponges and injections were prepared in the laboratory. Out of these 200 sponges and injections were given to Livestock Development officer, Veterinary Dispensary Grade-1, Mahabaleshwar, Dist. SATARA, Maharashtra for validation of the technology.

Induction of oestrus using intravaginal pessaries / injection during pre breeding summer season

Twenty five Sirohi goats were inserted with indigenously prepared intravaginal pessaries for 10 days Whereas At the time of insertion, 1ml injection was injected intramuscular.. These goats were randomly divided into two groups. Group 1 (n=7) goats were treated with 2 ml Receptal inj. 24hr before withdrawal of sponge. Group 2 (n=18) goats were treated with 350 IU of PMSG inj. 24hr before withdrawal of sponge. The intravaginal pessaries were removed 10 days after its insertion and each goat were treated with 1 ml of Cyclix (Cloprostenol). The does were observed for the onset of oestrus by the aproned buck daily in morning and evening. The oestrus response within 96 hr of treatment, onset of oestrus and duration of oestrus for Group1 and Group 2 following use of intra vaginal pessaries for induction of oestrus were 0%, 300+78.19, 16+2.52 and 75%, 51.75+5.66, 24.0+2.44, respectively. The result indicated that the induction of oestrus was significantly higher with 350 IU PMSG treatment as compare to 2 ml Receptal along with short term sponges treatment.

Induction of oestrus during breeding activity in winter (October-November)

Twenty Sirohi goats were randomly divided into two groups. Group 1 (n=10) goats were inserted with indigenously prepared intravaginal pessaries for 10 days and at the time of insertion, 1ml injection was injected intramuscular Group 2 (n=10) goats were inserted with indigenously prepared intravaginal pessaries for 10 days. This group was not injected 1 ml injection at the time of insertion of sponges.

All goats were treated with 350 IU of PMSG inj. 24hr before withdrawal of sponge. The intravaginal pessaries were removed 10 days after its insertion and each goat were treated with 1 ml of Cyclix (Cloprostenol) at the time of sponge withdrawal. The does were observed for the onset of oestrus by the aproned buck daily in morning and evening. The oestrus response, onset of oestrus, duration of oestrus, kidding percentage and kids/doe for Group1 and Group 2 following use of intra vaginal pessaries for induction of oestrus were 90%, 88.00+21.07, 20+3.00, 40%, 1.25 and 100%, 43.2+4.45, 28.8+2.65, 70%, 1.28 respectively.

Effect of PVP on in vitro maturation of caprine oocytes

The maturation and cleavage rate in TCM-199 with BSA and TCM-199 with PVP were 89.6% &

60.2% and 35.67% & 14.34%, respectively. The result revealed that maturation rate and cleavage rate in maturation medium supplemented with BSA is significantly higher as compared to PVP supplemented medium.

Effect of immunization on prolificacy of Sirohi goats

The aim of this study was to explore the possibility of increasing the ovulation rate of Sirohi goats by immunization against inhibin-based peptide immunogenes. Synthetic peptides mimicking α-subunit of porcine inhibin were conjugated to ovalbumin with the peptide-ovalbumin molar ratio being approximately 20:1 to increase their antigenicity. Primary immunization involved subcutaneous injection at two different sites of 400µg of peptide-ovalbumin conjugate dissolved in 1ml of isotonic saline emulsified with an equal volume of Freund's complete adjuvant to the treatment group comprising of five non-pregnant cyclic adult does. A control group of five non-pregnant cyclic adult does were injected subcutaneously with 400 µg of ovalbumin dissolved in 1ml of isotonic saline emulsified with an equal volume of Freund's complete adjuvant. After four weeks, each animal was given a booster dose of 200 µg of peptide-ovalbumin conjugate to treatment group and 200µg of ovalbumin to control group dissolved in 1ml of isotonic saline and emulsified with an equal volume of Freund's incomplete adjuvant. Estrus was synchronized by using a double injection schedule of PGF2± (Cloprostenol 263µg/ml/doe) on day 35 and 45 from the day of primary immunization. The plasma concentration of progesterone in the control and treatment group during the experiment was determined using enzyme immunosorbent assay. There was a significant difference in progesterone values in inhibin immunized group (9.58±5.51ng/ml) than that of control group (3.25±1.5ng/ml) on the day before the first PG injection. After the first PG injection, there was a decline in progesterone levels in the control group (1.75±0.75ng/ml) at the 8th day while the treatment group registered 8.58±5.35ng/ml. In a similar pattern 16 days after the second PG injection, the treatment group showed higher progesterone value (8.66±7.29ng/ml) compared to that of the control group (4.37±3.12ng/ml).

Despite the increase in the progesterone concentration an increase in prolificacy was not noticed in the treated group (only one goat kidded twin), nevertheless the increase in ovarian activity in term of higher progesterone has improved fertility (100% vs 80%). Thus, It can be concluded that inhibin immunization with a single booster dose resulted in increase in the ovarian activity and improvement in fertility but not prolificacy.

In-vitro embryo production and transfer

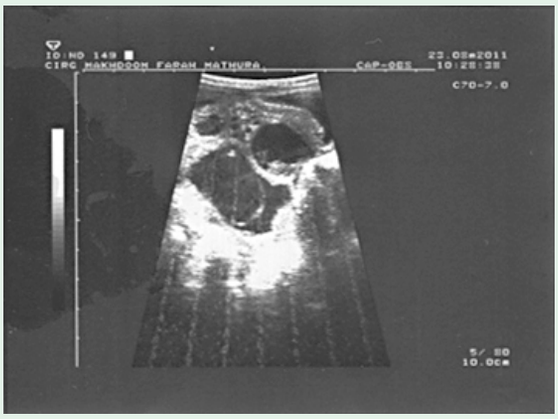
The overall percentage of 2-cell, 4-cell, 8-cell, 16-cell to morula and blastocyst were 13.00%, 22.11%, 32.47, 29.28% and 3.59%, respectively.

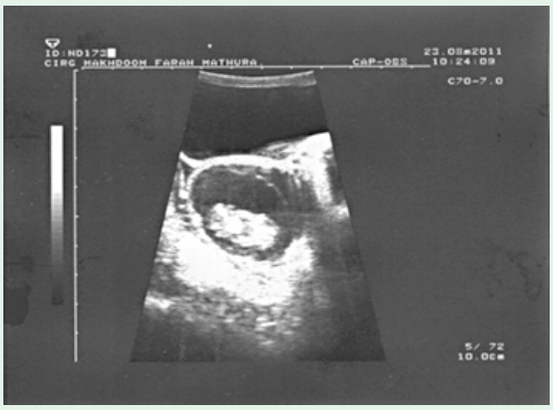
Twenty four in vitro produced embryos of 8-16 cell and morulla stage were transferred in to three natural synchronized recipients on day 3 or 4 post oestrous surgically at tip of the uterine horn of the genital organ. The recipient was monitored for the oestrus / pregnancy. Following transfer, pregnancy was detected by using ultrasound scanner at 8 weeks. These goats could not sustain pregnancy.

In-vivo embryo production and transfer/ MOET

Three adult, cyclic goats were superovulated for in vivo embryo production. To super ovulate, donor goat received 300 - 350 IU of FSH (Pluset, laboratorios Calier, SA) in tapering dose schedule at 12 hours interval in the morning and evening for 3 or 4 consecutive days, initiated on day 10 of the oestrous cycle. To regulate oestrous cycle each donor received a single dose of luteolytic drug (cyclix) @ 2.0 ml I/M along with concluding dose of gonadotropin. Donor goat was observed for onset of oestrus with an aproned buck twice a day at 12 hrs. interval. Donor exhibited standing oestrus within 48.00 hours of treatment. The donor goat was mated by a superior Sirohi buck during the standing oestrus. The recipient goats exhibiting oestrus

along with the donor were selected for embryo transfer at 84.00 hr following standing oestrus.





Superovulated goats were subjected to laparotomy at 84.00 hours after mating to record ovulatory response and subsequent flushing of embryos. The uterine horns and oviducts were flushed by retrograde method to collect the embryos. Total embryo / ova recovery were 12 embryos. Three embryos/recipient were subsequently transferred in two closely oestrus synchronized recipients and 2 embryos/ recipient were transferred into three recipients

(Total 5 recipients) at the tip of uterine horn ipsilateral to the corpus luteum bearing ovary. Each recipient were kept under observations for post-operative care till recovery.

Following transfer, pregnancy was initially confirmed at day 40 by real time ultrasonography in two recipients. Fetal reabsorption took place in one recipient after 40 days, while second recipient kidded with a twin (male and female).

XI/PRSM 2.03 : Economic managemental interventions for augmenting growth in kids

N. Ramachandran, S.K. Singh, M.K. Tripathi, V. Raj Kumar and B. Rai

An experiment was initiated during 2010 to assess the effect of curd feeding as a natural and easily available probiotic supplement on performance of Barbari kids from pre- weaning to market age and weight. A total of 40 Barbari kids of uniform age and live weight were randomly allocated in two groups of 20 kids in each. Kids were also grouped to unify sex and type of birth. Kids were allowed to suckle their dams until weaning (90 days of age), experiment was continued from pre- weaning (45 day of age) until 8 months of age with supplementation of goat milk curd at 15 ml per kid /day which was prepared fresh daily. The kids were maintained under group feeding management followed the routine managemental practices of the livestock sector.

Milk intake by kid suckling was recorded weekly, daily feed intake and live weight change were recorded weekly until weaning. Blood sampling was done at monthly intervals. Rumen fermentation pattern and microbial hydrolytic enzymes were estimated in rumen fluid samples at 4 hr post feeding during post weaning phase of experiment. Animals were also observed for the incidence of diarrhea and other illness, if any.

Supplementation of curd resulted in growth promotion of kids ranging from 4.0 to 29.1 %

with average 13.0 % from weaning to 8 months of age. Kids in the treatment group had finishing live weight 17.2 kg in comparison of 16.2 kg in control kids. Growth promotion was sizably higher (29 %) in kids supplemented curd during 3-6 months of age due to reduced impact of weaning stress. Feed intake improved linearly in both kid groups with progress of experiment; however kids of treatment group had a lower feed intake at weaning (5.9%) and during experiment (2.3%) than that of control kids. Kids had an ADG 73 and 76 g at weaning, 44 and 57 g at 3 to 6 months of age, 66 and 72 g at 6 to 8 months of age, and mean ADG 58 and 66 g during experiment respectively in control and curd supplemented kids. The kids consumed milk 239 and 214 ml per day in control and crud supplemented kids from 45 days of age until weaning. Kids of curd fed group consumed 12 % less milk than occurred in control kids. Under present experimental protocol curd fed kids had higher feed efficiency at all stages of growth. Kids of curd fed group consumed 7.5 kg feed while kids of control group consumed 11.0 kg feed for each kg gain during the experiment, which accounted feed efficiency 21 and 19 % respectively.

Rumen fermentation characteristics viz. pH, NH3-N, TCA-ppt Protein and TVFA were not affected by curd feeding in kids, which were similar between two groups. Extracellular microbial hydrolytic enzymes activity of carboxymethycellulase and xyalanase were similar between control and curd supplemented kids, while ± and ² glucosidase enzyme activity showed an increasing trend (p=0.107) in curd fed kids, which was higher by 14.55 units for ±-glucosidase and 1.62 units for ²-glucosidase in each 100 ml rumen fluid compared to control group.

Supplementation of natural probiotic as goat milk curd resulted an improved overall growth by 13 % with reduced feed (2.3%) and milk intake (12%) compared to control group.

Table 1 : Effect of curd feeding on rumen fermentation and microbial hydrolytic enzymes (4h post feeding)

	Dietary treatment*		SEM	Significance
	Control	Treatment		
Fermentation characteristics				
Rumen fluid pH	6.11	6.11	0.0537	0.258
NH_3-N (mg/dl)	61.54	64.36	7.377	0.678
TCA-ppt Protein (mg/dl)	22.36	23.22	1.479	0.702
TVFA (mEq/dl)	11.89	11.85	0.363	0.247
Microbial hydrolytic enzymes activity (U/100 ml)				
Carboxymethylcellulase	323.96	302.1	16.416	0.545
Xyalanase	7.77	5.24	1.101	0.299
α-glucosidase	16.34	30.89	3.85	0.101
β-glucosidase	18.39	20.01	3.149	0.107

*Control- no curd; Treatment-curd supplementation 15 ml/day

Developmental potency of parthenogenetic goat embryos (NAIP Component IV)

S.D. Kharche, A.K. Goel, S.K. Jindal

Oestrus detection and synchronization

Seventy goats were observed daily in the morning and evening for onset and duration of oestrus for synchronization with donor goats for embryo transfer. Out of these thirty nine goats were treated with prostaglandin-F2 alpha (cyclix) for oestrus synchronization. Out of 39 only 18 goats were responded to treatment (46.15%) and came in to oestrus in between 24hr to 96 hr of PG treatment during the period of May-July. Similarly, Out of 16 goat treated with PG, thirteen goats were responded to treatment (81.25%) and came in to oestrus in between 24hr to 96 hr of PG treatment during the period of Oct-Nov.

In vitro embryo production and transfer

The 40.00% cleavage rate from selected IVF goat oocytes was achieved. Similarly, the 8 cell (33.0%) and morula (36.0%) were produced from selected IVF goat oocytes

Twenty four *in vitro* produced embryos of 8-16 cell and morulla stage were transferred in to three natural synchronized recipients on day 3 or 4 post oestrous surgically at tip of the uterine horn of the genital organ. The recipient was monitored for the oestrus / pregnancy. Following transfer, pregnancy was detected by using ultrasound scanner at 8 weeks. These goats could not sustain pregnancy.

In vivo embryo production and transfer/ MOET

Eight adult, cyclic goats were superovulated for *in vivo* embryo production. To super ovulate, donor goat received 300 - 350 IU of FSH (Pluset, laboratories Calier, SA) in tapering dose schedule at 12 hours interval in the morning and evening for 3 or 4 consecutive days, initiated on day 10 of the oestrous cycle. To regulate oestrous cycle each donor received a single dose of luteolytic drug (cyclix) @ 2.0 ml I/M along with concluding dose of gonadotropin. Donor goats were observed for onset of oestrus with an aproned buck twice a day at 12 hrs. interval. Donor exhibited standing oestrus within 48.00 hours of treatment. The donor goat was mated by a superior Sirohi buck during the standing oestrus. The recipient goats exhibiting oestrus along with the donor were selected for embryo transfer at 84.00 hr following standing oestrus.

Superovulated goats were subjected to laparotomy at 84.00 hours after mating to record ovulatory response and subsequent flushing of embryos. The uterine horns and oviducts were flushed by retrograde method to collect the embryos. Total embryo / ova recovery were 22 embryos. The embryos were subsequently transferred in ten closely oestrus synchronized recipients at the tip of uterine horn ipsilateral to the corpus luteum bearing ovary. Each recipient were kept under observations for post-operative care till recovery.

Following transfer, pregnancy was initially confirmed by real time ultrasonography in three recipients. Out of three embryo transfer recipients, two recipients delivered two kids (01 male & 01 female) and third recipient kidded with a twin (male and female).

Parthenogenetic embryo production and transfer

Activation of oocytes : After in vitro maturation for 24–27 h, 1369 no. of oocytes were stripped off their cumulus cells by treatment with 0.1% hyaluronidase and gentle pipetting for 5 min in KSOM handling medium (Potassium simplex optimized medium). After maturation for 24–27 h, oocytes were stripped off their cumulus cells by treatment with 0.1% hyaluronidase and gentle pipetting for 5 min in KSOM handling medium (Potassium simplex optimized medium). The mature oocytes were activated in activation media consisting of 7% absolute ethanol in KSOM medium for 5 minutes. After 5 minutes activation, the oocytes were washed 5 to 10 times in the culture medium (KSOM) and cultured in 50 µl drop of KSOM containing DMAP and CCB for four hours in a CO_2

incubator at 38.5^{0}C in humidified atmosphere of 5% CO_2. After four hours of incubation, the oocytes were washed 5 to 10 times in the culture medium (KSOM) and cultured in 50 µl drop of KSOM.

Kids produced through MOET

***In vitro* culture of activated oocytes :** After 48 hours of parthenogenetic activation treatment, caprine oocytes were examined for cleavage under inverted phase contrast microscope. Development of parthenogenetic embryos were observed at every 48h till day 10 post activation under inverted phase contrast microscope (200x, Nikon, Japan). The culture media was replaced with freshly prepared embryo culture media after every 48 h and observations were made for subsequent embryos development.

The cleavage rate of selected partheno-genetically activated oocytes with ethanol and DMAP/CCB was 58.19%. The production of 8 cell, Morulea and blastocyst percentages were 24.00%, 38.18% and 5.51%, respectively.

Parthenogentic Embryo Transfer : Partheno-genetic goat embryos of 8-16 cell stage were transfer surgically in to 4 naturally synchronized recipients. Each recipients were kept under observation for post-operative care till recovery. One goat following transfer of parthenogenetic goat embryos was missed oestrus at four consecutive cycles. The goat following ultrasonography was found non pregnant.

Chromosomal Preparation for Haploid and Diploid Parthenogentic Embryo : The different cell stages of embryos were washed with KSOM media then incubated for 12 hour in 10 ìg/ml Colcemid to arrest the metaphase stage. The incubated embryos were washed with KSOM media and then treated with Pronase (0.25%) for the removal of zona pellucida. Blastomere separation was done by fine pipetting. The blastomeres were kept in a hypotonic solution (60mM KCL) for 4-5 minutes. The blastomeres were kept on clean dry microscope slide and allow to burst. The chromosal spread was fix with chilled solution of methanol:acetic acid (3:1) for 24 hr and then stained with 5% Giemsa stain for 30 minutes. The slide was washed with distilled water to remove stain. The slide is then examined under phase contrast microscope at 100x.

XI/PRSM/Network Project on adaptation of livestock to impending climatic changes through shelter management

S.K. Jindal, N. Ramachandran, Neeru Bhushan, B. Rai and R. Priyadharshini

The experiment was carried out at the experimental shed of the Physiology Reproduction and Shelter Management Division, CIRG Makhdoom, Farah, Mathura (U.P.). Twenty four Sirohi and Twenty four Barbari female adult goats were selected randomly according to their age (4-5 years old) and body weight and maintained under (TH, AH & OH). Eight-Eight Sirohi and Barbari goats were assigned under each housing system (TH, AH and OH), respectively. Physiological measurements of Sirohi and Barbari goats under different housing system were taken thrice in a fortnight. The measurements were made twice a day ie morning between 8:00-9:00h and afternoon between 15:00-16:00h.The experiment was under taken during Hot dry (April- May, 2011) and Hot humid (July-August, 2011) seasons.

Suitable Thatch House (above) and Asbestos House (below) for goat

There was no significant difference in RT (Pd"0.05) between the breeds in different shelter. But RR and HR decreased in thatch as compared to asbestos and open shed.Feed and water consumption significantly increased in thatch panel as compared to other sheds. Blood biochemical & hematological profile were significantly lower in thatch compared to Asbestos and Open. Hormone concentration also fluctuated, T4 value was significantly higher (95.72 ±6.47, sirohi) in thatch, 82.33 ±6.84,Barbari) in open shed. T3 values were significantly lower in thatch shed in both breeds i.e 1.07 ±0.70 (ng/ml) (Sirohi)and 1.14 ±0.10(ng/ml) (Barbari) . Cortisol (ìg/dl) concentration were significantly lower in thatch shed in both breeds i.e 8.89±0.72 (Sirohi) and 8.71± 0.83 (Barbari). Sodium (mmol/L) concentrations were significantly higher in open housing in both breeds i.e. 143 ±7.41 (Sirohi) 161.62 ±7.07(Barbari). Potassium (mmol/L) concentration were significantly higher in open housing in Barbari goats i.e. 4.86 ±0.24 and in thatch housing in Sirohi goat ie 4.88 ±0.88. Finally, in hot dry period, both breeds were comfortable in thatch shed than in other sheds.

Hot Humid Period : Physiological responses were significantly higher in thatch shed as compared to asbestos. But DMI was higher in asbestos shed.Therefore, it seems that in hot Humid period asbestos housing was more effective than thatch shed for goats.

Holistic Approach for improving Livelihood Security Through Livestock based Farming System in Barabanki and Raebareli districts of U.P.(NAIP Component III)

B. Rai, Ashok Kumar and M.K. Singh

Data was collected from 5 villages of Lalganj block of Raebreilly district and 7 villages of Hydergarh and Trivediganj blocks of Barabanki district U.P. A total of 134 households keeping goats were surveyed. Mostly (80%) goat keepers belonged to socio-economically backward (SC,OBC and Muslims) communities. The major occupation of these goat keepers was working as labour in fields, MANREGA and petty works in nearby towns. Some (18%) goat keepers had small piece of land where they were growing vegetables and with the intervention of this project have also started producing fruits and flowers to sustain their livelihood. During this year 83 Sirohi goats and 19 adult breeding bucks of Sirohi breed were distributed in Lalganj area of Raebreilly district to ensure livelihood security of the goat keepers.The Sirohi goats already distributed (2009-10) in Hydergarh and Trivediganj area of Barabanki district are doing well, the crossbred kids born using Sirohi bucks attained higher body weights 18- 20 kg as compared to 15-17kg to non-descript kids. The Sirohi goats produced milk 0.8-1.8 lit/d with a lactation length of 6-7months under field conditions. Few (12%) goat keepers sold the

surplus goat milk @Rs. 12/litre to sustain their livelihood. The goat rearing In this region is practiced under extensive system of management and there is a great need to sensitize the goat keepers for supplementary feeding and health related interventions specially during crucial periods of production like breeding, lactation and growth. With the intervention of this project the goat keepers in the adopted areas are sensitised for supplementary feeding and health care of their goats. Few farmers from both the districts are keen to start goat rearing on commercial lines. Goat + rural poultry + fruit or vegetable crops emerged as a successful IFS model for Landless , marginal and small farmers in this region. This model is fit for earning livelihood in limited resources.

Marketing of Goats

The marketing aspect of goats was studied in both the districts with the help of survey. The study indicated that the goat keepers fail to get optimum selling price of the goats/kids due to unorganised goat marketing system in this region. Normally, the middleman purchase their goats at a lower price and earn higher money in the market. The reason and purpose of sale of goats was the surplus males followed by unproductive and diseased stock in the farmers flock. The returns from sale of goats were mainly utilized to fulfill family needs including food, followed by meeting social obligations and emergencies like illness.

The small goat flocks are quite in large numbers with the farmers and they feel that it is non-economical to take few goats in market and is the biggest (55%) reasons for selling the goats at their doorstep. In farmer's perception, the distress sale and lack of market information were the two major reasons for low price of their goats The health and age of goats were the two major factors for deciding the price under field conditions. It is evident from this study that there is a need of proper goat marketing channel in this area for benefit of goat keepers and to increase their income from goat rearing.

Quintuplets Kids Born to Barbari Goat Through CIRG Superior Caprine Germplasm

A rare distinction realting to performance of CIRG superior goat genetic resource was witnessed in form of birth of quintuplets consisting of 2 males and 3 females to a Barbari doe in the nearby village-Makhdoom on 25-10-2011. This phenomenal achievement is the result of superior germ plasm introduced in the village by CIRG under transfer of technology (TOT) project. This particular doe is having high fecundity and producd 8 offsprings in two successive kidding. Normally, Barbari goat delivers single, twins and triplets but the birth ofquintupletsis a rare occurrence. The health of kids and doe was found satisfactory and average body weight of ofssprings was ~ 1.5 kg/ kid after three days of birth. This elite doe belonged to Smt. Urmila Devi, a former village-head (*Pradhan*). She maintains 8-10 goats and earns an additional annual income of Rs. 15,000 – 18,000 to her family from goat rearing alone. In order to conserve valuable genetic resource, CIRG has extended technology support for health, nutrition and care of these kids. The lady has acknowledged technological inputs received by farmers from CIRG for improving socio-economic status of poor goat keepers.

NUTRITION, FEED RESOURCES & PRODUCT TECHNOLOGY DIVISION

Project No. XI-NFRPT 1.01 : Development of fodder production, conservation and processing technologies for small holders and commercial goat farmers

Prabhat Tripathi and T.K. Dutta (upto 31 January, 2012)

Evaluation of pasture herbage through grazing trials

Three pastoral models having one hectare area in each were evaluated for their primary production performance as well as for secondary production performance during summer months under rain-fed Yamuna ravine soils. These models namely were Cenchrus ciliaris pasture, Zizyphus based silvipasture and natural pasture.

The group of six adult Barbari male goats grazed for 6 h in each model. After that each animal was supplemented with concentrate pelleted feed (100 g/animal)and this quantity was enhanced up to 200g /animal to maintain their body weight on the advancement of summer season, because the condition of all pasture models deteriorated in terms of quality biomass production during summer months and body weight of grazing animals start declining. Routine sampling from these models wereobtained for primary production parametersand for digestibility studies chromic oxide based indicator method was adopted. At the start of summer months dry matter digestibility ranged from 51.07 to 57.84 per cent which reduced and ranged from 46.78 to 51.62 at the end of summer season among the models. Dry matter intake was higher at the beginning of summer months which was reduced drastically with the progress of summer season, at the end of experiment it ranged from 2.4 to 2.81 % B.W. among models. Maximum dry matter intake was in *C.ciliaris* pasture at both the stages of summer months. The composite biomass of each model was also analysed for tanins and total phenols. The progress of summer enhanced the content of tannins and total phenols in to the grazing materials in each model. Total tanins content at the start of summer months ranged from 0.56 to 2.59 percent and total phenols were 3.62 to 4.39 percent, However, at the end of summer months these were 1.37 to 3.98 percent and 5.68 to 6.44 percent respectively. The average CP contents during summer were 10.75, 11.87 and 10.47 percent in *C.ciliaris* pasture, *Zizyphus* based silvipasture and natural pasture, respectively.

Evaluation of legumes as goat feed

Three legumes crops namely Lobia *(Vigna unguiculata)* Moong *(Vigna radiata)* and Guar *(Cyamopsis tetragonoloba)* were evaluated as green feed during kharif season. Each legume crop was harvested between flowering and pod initiation stage and offered to six adult Barbari male goats *ad.lib.*after chaffing. After five days preliminary feeding these goats were fed 21 days with these legumes followed by a metabolism trial of six days duration. Maximum CP i.e.18.08 percent was in Lobia fodder followed by Guar 17.13 percent. NDF content in legume green fodder was 44.86, 43.66 and 46.95 percent in Lobia, Moong and Guar respectively.

Among three legume fodders the highest dry matter and crude protein digestibility recorded with Lobia i.e. 61.89 and 68.87 percent respectively. TDN and DCP with 58.82 and 12.45 % in Lobia wasthe highest over rest two legumes. However, dry matter intake (% BW) 2.93 was maximum with Moong fodder and lowest 2.48 with Guar fodder.

Response of Barley crop to various organic manure treatments

An experiment was laid out in factorial arrangement during rabi season to study the response of barley crop to organic manure

treatments. These treatments were Vermicompost @15, 10, 5, 2.5 t/ha, Goat manure (FYM) 15, 10, 5, 2.5 t/ha, Goat manure + Vermicompost @10t/ha, Vermiwash spray, Urea application and control. After treatment application barley crop was allowed to grow under two conditions i.e. with single cutting and without cutting. Plant growth parameters were recorded and post-harvest parameters will be studied after crop harvesting.

IMPROVEMENT OF FEED RESOURCES AND NUTRIENT UTILIZATION IN GRAZING ANIMAL PRODUCTION (AICRP/XI/01)

U.B. Chaudhary, T.K. Dutta, A.K. Das, Ashok Kumar and M.K. Tripathi

Influence of chelated minerals supplementation was assessed on growth, immunity and reproductive performance of goats. Thirty Barbari males of average 25 kg live weight and 475 days of age were maintained for 120 days in three equal groups. Each animal daily received 1 kg green Barseem fodder and free choice of gram straw. The concentrate mixture fed at 1.5 % of live weight, which contained either organic or in-organic sources of Cu and Zn as per requirement. Concentrate mixture fed to control group of animals did not had added Cu and Zn. Growth performance did not change by the type and level of Cu and Zn supplementation, and average daily gain of the animals ranged from 87 to 110 g among three groups. Although, gain was statistically similar but was higher in mineral supplemented animals. Similarly, haematological attributes (Hb, HCT, RBC and WBC) did not change by form and level of Cu and Zn supplementation, while these attributes improved with the period of experiment. Supplementation of Cu and Zn in either form reduced platelet counts ($P<0.001$). Chelated Cu and Zn supplementation improved immunity status of animals, as the supplemented group had the highest immunoglobulin levels followed by inorganic Cu and Zn supplemented animals and the lowest in animals, which did not receive supplemental Cu and Zn. The libido of bucks was excellent in mineral supplemented animals than the control however, sexual desire was similar between inorganic and chelated mineral groups. Minerals supplemented animals had the superior sperm mass motility than in control animals. Sperm motility was higher by 23 % in Cu and Zn supplemented animals in comparison to control. Similarly, abnormal sperm numbers were lower in mineral supplemented animals than in control. However, sperm density was similar among three animal groups. Study suggested that the supplementation of Cu and Zn in adult male goats tends to enhance growth, while chelated sources of Cu and Zn provided higher immunity status. Improved male reproductive performance upon Cu and Zn supplementation includes enhanced sexual desire, higher sperm motility and reduced numbers of abnormal sperms.

	Added Mineral supplementation		
	Not-supplemented	Inorganic Cu & Zn	Organic Cu & Zn
Growth performance			
Initial weight (kg)	25. 5	25.4	25.5
Final weight (kg)	35.8	37.5	36.1
ADG (g/d)	86.9	100.4	91.8
Reproductive traits (Seminal)			
Volume (ml)	0.58	0.98	0.76
Initial motility (%)	62.00	84.00	76.00
Total Abnormal sperms (%)	2.94	2.51	2.21

NFRPT-2.01 : Studies on nutritional value of goat milk

R.B. Sharma and A.K. Das

Effect of breeds on goat milk composition

Milk samples were collected from different units of goats maintained at the Institute to study the effect of breeds on goat milk composition. Fat content was noticed significantly higher in Jakhrana goat milk followed by Sirohi and Jamunapari milk. Barbari goat milk had comparatively lower amount of fat. The content of other constituents like S.N.F., T.S., protein, lactose and ash were also found lower in Barbari goat milk. However, no significant difference (except fat) was observed among the other three breeds (Table 1).

Table 1: Effect of different breeds on goat milk composition (%)

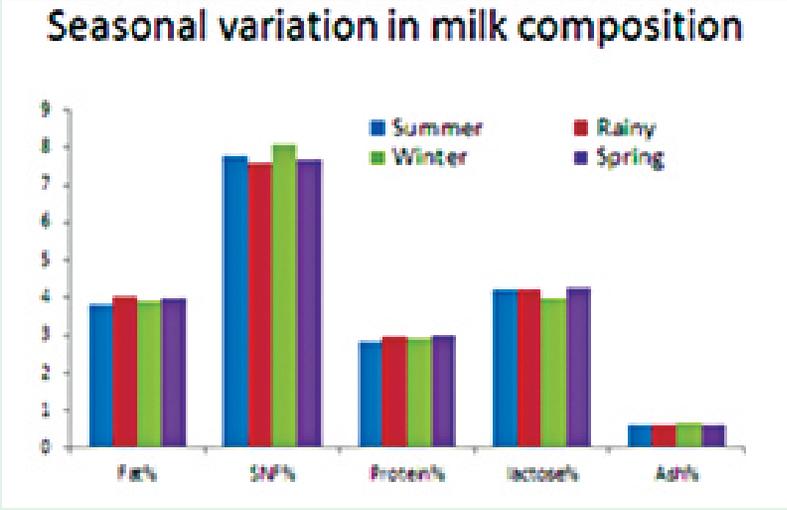
Breed	Fat	S.N.F.	T.S.	Protein	Lactose	Ash
Barbari (N=121)	$3.69^{A}\pm0.04$	$7.32^{B}\pm0.06$	$10.99^{B}\pm0.08$	$2.67^{B}\pm0.21$	$4.01^{B}\pm0.05$	$0.61^{B}\pm0.004$
Jamunapari (N=121)	$3.89^{B}\pm0.04$	$7.84^{A}\pm0.05$	$11.71^{A}\pm0.07$	$2.96^{A}\pm0.03$	$4.29^{A}\pm0.34$	$0.65^{A}\pm0.004$
Jakhrana (N=121)	$4.04^{C}\pm0.04$	$7.82^{A}\pm0.05$	$11.86^{A}\pm0.07$	$2.95^{A}\pm0.03$	$4.18^{A}\pm0.04$	$0.64^{A}\pm0.003$
Sirohi (N=121)	$3.95^{BC}\pm0.04$	$7.79^{A}\pm0.05$	$11.72^{A}\pm0.07$	$2.96^{A}\pm0.03$	$4.22^{A}\pm0.04$	$0.65^{A}\pm0.003$

Variation in goat milk composition during different months

Pooled goat milk samples (605 Nos.) were collected during different months to study the milk composition. Fat content (4.22±0.01) was higher during the month of August; Whereas S.N.F. was higher during December and January. The lowest fat and S.N.F. were found during the month of February.

Effect of seasons on goat milk composition and paneer yield

Fat content in goat milk was observed significantly higher during rainy season followed by spring and winter/summer seasons. However, S.N.F. content was highest in winter and lowest during rainy season. Total solids and ash content were higher during winter season. Protein content was lower in summer season in comparison to other seasons. Lactose content was significantly lower during winter season(Table-2).Table-2: Effect of the different seasons on Goat milk constituents (%)



Season	Fat	S.N.F.	T.S.	Protein	Lactose	Ash
Summer(270)	$3.82^{A}\pm0.03$	$7.75^{B}\pm0.03$	$11.55^{B}\pm0.05$	$2.83^{B}\pm0.02$	$4.21^{A}\pm0.03$	$0.64^{B}\pm0.002$
Rainy(195)	$4.04^{B}\pm0.03$	$7.59^{C}\pm0.04$	$11.57^{B}\pm0.06$	$2.96^{A}\pm0.04$	$4.22^{A}\pm0.03$	$0.63^{B}\pm0.003$
Winter(100)	$3.89^{A}\pm0.05$	$8.07^{A}\pm0.08$	$11.97^{A}\pm0.09$	$2.93^{A}\pm0.03$	$3.99^{B}\pm0.06$	$0.66^{A}\pm0.006$
Spring(40)	$3.99^{B}\pm0.07$	$7.67^{BC}\pm0.12$	$11.63^{B}\pm0.015$	$2.99^{A}\pm0.07$	$4.27^{A}\pm0.06$	$0.63^{B}\pm0.005$

Correlation between total solids of goat milk and paneer yield

Total solids content in goat milk were significantly higher during winter season and lowest during summer season. As a result higher paneer yield was obtained in winter season and lowest in summer season. Results indicated a positive correlation between total solids and paneer yield.

Nutritional approach for designing goat meat based functional products (MOFPI Funded)

V. Rajkumar, A. K. Das and A. K. Verma

Evaluation of antioxidant potential of Herbal based goat meat nuggets

Formulation for the herbal based goat meat nuggets were standardized using the following herbs (CIRG-GPT Herb or CGH 1, 2 and 3). CIRG-GPT Herb (CGH 1) was used at an acceptable level of 0.5 % and CGH 2 and CGH 3 were used at 0.25 % level in the nuggets. There was no significant difference in the emulsion stability. Cooking yield was high in CGH 1 and CGH 2 nuggets followed by CGH 3. Though there was no significant difference in the emulsion pH, the product pH differed significantly. CGH 3 nuggets were softer than the other nuggets prepared from different herbs. CGH 1 nuggets were also lighter in colour.

Physico-chemical properties and quality of goat meat nuggets prepared from Aloe Vera Gel

Aloe vera gel is endowed with numerous nutritional and health values and its incorporation in emulsion based goat meat nuggets would definitely enrich the functional value of the products. Before inclusion the proximate composition of aloe vera gel (AVG) was studied. The moisture content of AVG was 98 %. In the present study AVG was incorporated in the goat meat nuggets at two different 2.5 and 5.0% levels. Incorporation of 5 % AVG significantly increased the emulsion pH and improved product yield. Emulsion and products with AVG had significantly high moisture while percent protein and product fat content decreased as the level of addition increased. Texture profile analysis revealed that goat meat nuggets with AVG were comparatively softer and had less hardness, gumminess and chewiness and shear force with respect to control nuggets. The incorporation of AVGat 5% in goat meat nuggets significantly decreased the proportion of C6:0 and C18:0 in the products. There was decreasing trends in the proportion of saturated fatty acids in the products with AVG while percent monounsaturated fatty acid showed reverse trends. Organoleptic evaluation of the products exhibited that nuggets with AVG received significantly lower flavour and texture scores which could have resulted in lower products overall acceptability in comparison to control nuggets. However, all the sensory scores of the AVG nuggets were remained close to very good. Shelf life studies revealed that the all products were safe up to 21 days of storage at 4 ± 1^{0}C.

Studies on shelf-life of sweet lemon albido fiber enriched goat meat nuggets

Sweet lemon albedo is a by-product of citrus fruit industry and a good source of dietary fiber. In the study fresh albedo was brought to the laboratory before 2 hours, washed in running tap water, removed the seeds, boiled for 5 min, drained excess water, grinded to paste (95 %

moisture) and kept under -20°C before use in the formulation of goat meat nuggets. On dry matter basis albedo had 59 % total dietary fiber, in which soluble fiber content was 7 %. Albedo paste was used to replace 5% and 10% lean meat in product formulation.Addition of albedo did not significantly affect the emulsion stability and product yield. The expressible water, emulsion pH, protein, ash, nuggets pH, moisture, protein and ash contents were significantly ($p<0.05$) affected by albedo inclusion. The nuggets having 10% albedo paste had 6.37 pH. The moisture, fat, protein and ash were 70.70, 7.93, 13.02 and 2.72 per cent respectively. Lower force was required to compress or shear the sample as hardness, springiness, gumminess and chewiness decreased in nuggets included with 10% sweet lemon albedo paste. Shear force values and work of shear were also significantly lower in the goat meat nuggets with 10% albedo. Hunter colour analyses revealed that the red colour values were significantly ($p<0.05$) affected. Nuggets with 5 % albedo had the highest red colour value (8.29). Lightness values (43.21) of the 10% albedo included nuggets were non-significantly higher. Sweet lemon albedo, did not affect sensory attributes. Products packed under aerobic and vacuum had a shelf life of 14 days at 4±1°C. It is concluded that sweet lemon albedo could be incorporated in comminuted meat systems for producing quality products having the rich source of dietary fiber and the product could be more functional in nature.

Studies on Growth and immune-modulatory effect of herbal goat meat products in the laboratory animals -Mice

Mice (BALB/c), weighing between 20 and 25 g of either sex (Male - 30 and Female - 20) were used to evaluate the immunomodulatory activity of herbal goat meat products. The study is in progress.

Table . Shelf life of sweet lemon albido goat meat nuggets

Product	Method of Packaging	Days of storage at 4±1°C		
		0	7	14
Control	AP	1.08±0.01	2.06±0.02	3.24±0.04
	VP	1.08±0.02	1.95±0.26	3.08±0.14
Treatment 1	AP	1.16±0.12	2.18±0.24	2.87±0.13
	VP	1.14±0.01	1.48±0.16	2.08±0.04
Treatment 2	AP	1.86±0.22	2.26±0.17	4.04±0.24
	VP	1.92±0.26	0.56±0.22	2.61±0.03

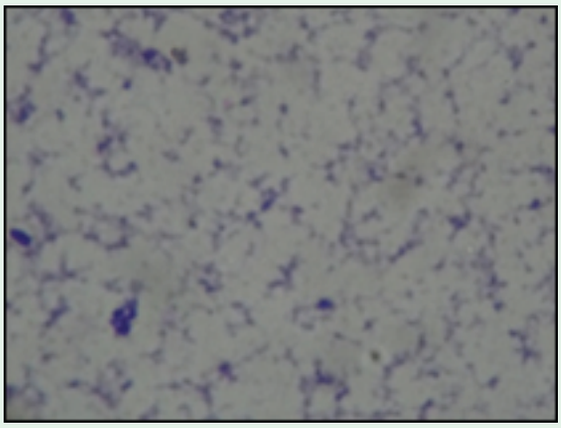
AP: Aerobic Packaging; VP: Vacuum Packaging

Net-work programme on veterinary Type culture (Rumen microbes)

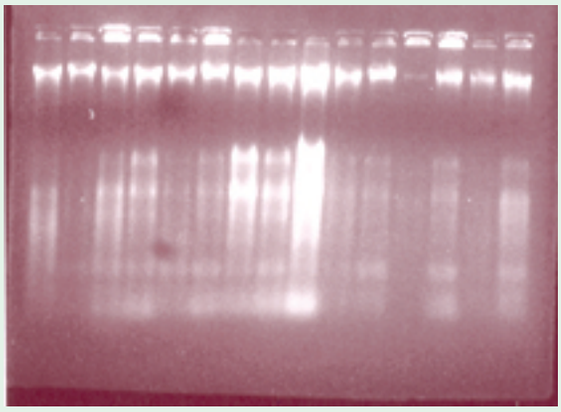
U.B. Chaudhary , T.K. Dutta and V.K. Gupta

Rumen liquor samples form grazing goats maintained under intensive systems of feeding management were collected for isolation of anaerobic cellulose degrading bacteria. The microcrystalline cellulose degrading bacteria from these goats were cultivated and isolated. DNA of all the isolates extracted and PCR for amplification 16S RNA gene using custom synthesized specific primers was done for identification and Characterization of isolates at molecular level. Total 42 isolates of fiber degrading bacteria were identified from the goat rumen and subjected for characterization. Out of these 42 isolates, 11 were characterized and being submitted to the coordinated unit.

The biochemical analysis of the culture supernatant of these isolates indicated improved fibrlytic activities in terms of microcrystalline and aviclase enzyme concentration. The fiber degrading activities of these isolated are being analyzed using in vitro technioque.



Cellulose degrading Bacteria isolated from goat rumen



DNA of Cellulose degrading bacteria

Network Programme on Estimation of methane emission under different feeding systems and development of mitigation strategies

U.B. Chaudhary and M.K. Tripathi

Determination of in vitro methane production at t ½ of different feeds and their combinations

The in-vitro dry matter and organic matter digestibility, total gas production and methane production (ml/ g DM) at their t ½ was estimated using glass syringe method. Feed resources evaluated includs crop residues (Gram straw, arhar straw, wheat straw, lobia straw and guar straw), top feeds (Peepal leaves, neem leaves, ber leaves, siris leaves, subabool leaves, remja leaves, chonkra leaves, sahtoot leaves and mixed leaves), energy and protein supplements (barley grains, bajra grain, wheat bran), compound feed (concentrate pellet) and their different combinations. Among straw, highest methane production (ml/g DM) was with arhar straw (24.63) while the lowest methane was with guar straw (4.2). Methane production (ml/ g DM) of top feed resources varied from 1.65 to 7.18 ml at their corresponding t1/2 of fermentation. The methane production (ml/g DM) of barley grains, bajra grain and wheat bran was 14.18, 15.71 and 1.45 ml respectively. The pelleted feed produced 2.7 methane (ml/g DM) at their corresponding t1/2 period. The methane production (ml/g DM) varied from 1.32 to 12.08 ml in different combination of feeds.

Feed groups	Feeds	Methane production
Crop residues (straw)	Gram straw, arhar straw, wheat straw, lobia straw and guar straw	Highest methane from Arahr straw and lowest from gwar
Top feeds	Peepal leaves, neem leaves, ber leaves, siris leaves, subabool leaves, remja leaves, chonkra leaves, sahtoot leaves and mixed leaves	1.65 to 7.18 (ml/g DM)
Protein and energy supplements	barley grains, bajra grain, compound feed their different combinations	1.32 to 12.08 (ml/g DM)

Development of herbal medicated pelleted diet for enhancing goat productivity

Ravindra Kumar, U.B. Chaudhary, Ashok Kumar and D.K. Sharma

In order to achieve optimum growth with reduced coccidial load and methane production, complete medicated pelleted diets with roughage and conc. (60:40) were formulated as per detailed below.

Normal complete pellet (T1) -No addition; Chemical anticoccidial pellet (T2) - Chemical anticoccidial was added as feed mix ;Herbal anticoccidial pellet (T3) - Herbal anticoccidial was added as feed mix; Antimethanogenic pellet (T4) - Antimethanogenic plant was added.

Herbal anticoccidial and antimethanogenic pellet (T5) - Antimethanogenic plant and Herbal anticoccidial was added as feed mix.

In vivo evaluation of these five pellets was carried out in five groups of barbari goats (age 3-4months) because coccidiosis is quite prevalent in this age group of goats. During 120 days experimental feeding daily feed intake, fortnightly body weight gain, blood parameters, rumen fermentation parameters, oocyst count (OPG) and methane production was estimated. The dry matter intake/day (g) was similar (P> 0.05) in all the group of goats. The average daily gain (g) was the highest in T5 (78.68) andthe lowest in T1 (control) (40.41). There was significant (P<0.05) improvement in body weight gain after anticoccidial addition of chemical or herbal origin (Table 1).

Table 1.Performance, intake and rumen metabolites of goats on different types of pellets

Attributes	T1	T2	T3	T4	T5	SEM	P value
Initial body wt. (Kg)	10.23	9.87	10.07	9.56	10.10	0.51	0.99
Final body wt. (Kg)	15.16	16.40	16.42	18.22	19.70	0.93	0.60
Avg. Daily gain (g)	40.41^{b}	53.52^{ab}	52.05^{ab}	70.98^{a}	78.68^{a}	2.81	0.045
DMI/day (g)	549.84	544.87	542.75	617.96	621.67	13.29	0.105
DMI/% B. Wt.	4.71	4.48	4.56	4.76	4.51	0.048	0.254
DMI(g)/$Kg^{0.75}$	87.08^{ab}	83.56^{b}	84.64^{b}	90.16^{a}	86.71^{ab}	0.80	0.042
pH	6.37	6.24	6.22	6.20	6.19	0.03	0.55
NH_3-N (mg/dl)	22.12	22.40	22.12	26.04	25.08	0.75	0.30
TVFA (mmol/dl)	10.88^{b}	11.02^{b}	13.50^{a}	13.74^{a}	12.04^{ab}	0.34	0.00
% Acetate	69.63	67.95	67.71	65.92	65.76	0.74	0.47
% Propionate	14.84	18.61	20.01	21.37	22.62	0.91	0.05
% Butyrate	15.51^{a}	13.43^{ab}	12.27^{ab}	12.70^{ab}	11.60^{b}	0.54	0.20
Ac: Pr ratio	5.50^{a}	4.04^{ab}	3.44^{b}	3.11^{b}	2.91^{b}	0.32	0.06

There was no difference in ruminal pH, ammonia nitrogen among different group of goats while higher total volatile fatty acid in treatment groups (Table 1). Significantly (P<0.05) lower acetate to propionate ratio was in T3, T4 and T5 group of goat showing a channelling of hydrogen to propionate production in place of methane formation.

Significantly low level of hemoglobin, hematocrit and high level of MCHC was observed in control group as compared to treatment groups of goats. No difference in RBC, WBC and platelates count was observed.

No difference in the total protein and its fractions was observed. Low haemoglobin and hematocrit value may be due to coccidial infection in control group of goats. Methane

emission expressed as both quantity per day or relative to DMI was lower (P< 0.05) for T4 and T5 than for control (T1) (10.08, 8.17 vs.15.40 g/d and 14.15, 11.26 vs.20.88 g/d).

The difference may be due to higher propionate and lower acetate production in these groups. No definite conclusion can be drawn from OPG count of faeces collected during experimental feeding but the production parameters affected due to coccidial infection get improved by feeding of anticoccidial pellet. Therefore, herbal anticoccidial pellet can replace chemical anticoccidial compound in feed mix thereby reducing the chemical residue in goat products. Antimethanogenic pellet can also improve the production performance of goats along with a check on methane production. Further trial is going on anticoccidial pellets having different herbal formulation as feed mix.

PRODUCTION OF SUPERIOR GERMPLASM USING MULTIPLE OVULATION AND EMBRYO TRANSFER

Multiple ovulation and embryo transfer (MOET)is used to induce multiple follicles to grow and ovulate so that their oocytes (eggs) can become fertilized and resulting embryos can be collected from genetically valuable donor females. Subsequent transfer of these embryos to recipient females even of poor genetic value will lead to production of improved germ plasm. Research work undertaken by the team of CIRG scientists under NAIP has produced encouraging output, in this direction.

In an experiment, morphological normal, good quality embryos were recovered from a Sirohi goat (donor). The collected embryos were then transferred in four closely oestrus synchronized recipients (2 embryos/recipient) of non-descript goat breed. The pregnancy was initially confirmed between day 35 and 40 by real time ultrasonography. On completion of gestation, three surrogate mothers produced four kids (2 male & 2 female) from a single Sirohi donor. Earlier the scientist have successfully used MOET technology in producing kids in Jakhrana and Jamunapri goats and the present findings, therefore confirmed and validate that MOET technology can be used in other breeds as well for multiplication of superior germplasm.

Sirohi is a large size goat breed of semi-arid area. It plays an important role in livelihood of millions of resource poor people. Owing to large size, this breed is very much liked by the farmers. However the Sirohi goat is less prolific with low twinning rate (10%) resulting in relatively less multiplication of genetic resources. The MOET technology standardized by CIRG scientist under the leadership of Dr. S. D. Kharche in collaboration with Dr. A. K. Goel and Dr. S. K. Jindal, would go a long way in improving the multiplication potential of Sirohi goat.

GOAT HEALTH DIVISION

XI/GH-1 : Monitoring and surveillance of important goat diseases in India

D.K. Sharma, V. K. Gupta, Ashok Kumar, V.S. Vihan (upto May 2011), A.K Mishra, Manjunath Reddy, N. Shivasaranappa

Information was collected from state of Assam, Odisha and Arunachal Pradesh through personal visit to Direcortate of Animal Husbandry and Veterinary Services of these states for secondary data. Visits also included the AICRP (Goat) units in Assam Agriculture University at College of Veterinary Science Khanapara, Guwahati and Ganjam unit of Goats in Ganjam, Odisha.

Assam

During sample survey conducted in 2003-04 by state department, goat population of Assam state was observed to 26.14 lakh which make a total of 19.64 percent of total livestock populationof the state. There are 3 government goat farms at Kokarajhar, Karbi Anglong and Kamrup district. Prevalent diseases as observed by state Animal Disease Monitoring and surveillance agency were FMD, PPR, Goat Pox and Contagious ecthyma among the viral diseases. As the data recorded in state was not specific for goats, the number of outbreaks, morbidity and mortality among goats remained obscure. Enterotoxaemia was however only reported bacterial disease in goats. Though parasitic diseases like Babesiosis, Anaplasmosis, Amphisotomiasis, Fascioliasis, Strongylosis and Coccidiosis etc were reported in state of Assam, not a single case in goats has been recorded. However, the report of Directorate of Animal Husbandry and Veterinary Service Guwahati showed the occurrence of Tape worm and Round worm infections.

FMD: Last 5 years observation, however, revealed a regular occurrence of FMD in goats starting from 2007 to 2011. Though morbidity and mortality rates as such have not been reported, yet sufficient number of cases has been recorded. As no regular screening of goats for FMD was practiced the data seemed to be under reported. On the other hand, FMD- ADMAS project unit has reported a total of 35 outbreaks in 2010-11 and 15 in 2009-10 in cattle from 15 and 6 districts of Assam respectively, however, the report was silent on outbreaks in goats except the mention of death of 5 animal with feet lesions.

PPR: PPR occurrence in goats in the state of Assam seemed to be an emerging problem and for last 3 years the disease has occurred in goats of Government Farms. Epidemiology of the disease traces back the origin of PPR infection from Sirohi goats transported to the state of Assam from Rajasthan. The vaccination of PPR, however, was not regular.

Goat Pox: State Animal disease monitoring and surveillance agency failed to detect a single case of disease. However, under FMD- ADMAS project pox has been described as an endemic infection in the state.

Brucellosis: Regular reporting of bovine, bubaline and swine Brucellosis was made from Assam state under the ADMAS project. However, no report of Goat brucellosis was available from Directorate of Animal Husbandry and Veterinary Services. The farmers at AICRP units however, reported abortion in goats.

Mange: Discussion with farmers at different AICRP units in different villages revealed thatdue to hot humid conditions in Asom, the goats were very prone to mange. The type of mange was Sarcoptic being rampant in Assam goats.

AICRP units at **Batabari, Tatelia** and **Nahira** villages were visited and samples blood sera and faecal samples were collected for laboratory examination.

Table 1: PPR occurrence in Assam

Year	Farm/District	Seroprevalence (Per cent)	Outbreaks	Morbidity (Per cent)	Mortality (Per cent)
2009-10	Chilonijan Govt. Goat Farm, Karbi Anglong	Kids - 77.77 Adults- 88.88	1	217 animals	-
2010-11	Panbari, Govt. Goat Farm, Kokarajhar	17	1	16.66 percent	75
2011-12	Tapia, Hajo Kamrup	-	1	-	20 Animals

Odisha

State livestock census survey revealed total of 59.74 lakh goats in 91349 villages of Odisha. Directorate of Animal Husbandry and Veterinary Services along with Animal Disease Research Institute at Phulnakhara has an overview of disease status. The commonly occurring diseases in goats are FMD, PPR, Goat Pox, CCPP along with parasitic infections like Theileriasis, Babesiasis, Amphisotomiasis etc.

FMD: As observed under FMD – ADMAS project, the FMD outbreaks were common in Odisha. However, the observations were restricted to cattle mainly and goat data on FMD remained obscure. For last 5 years observations revealed 2 outbreaks in Goats (2007-08) resulting in 62 deaths in 130 goats affected (47.69 %). Occurrence of the disease in cattle were noticed in 9 districts in 2006-07 increased to 21 in 2009-10. Under such circumstance, the observations on goats seem to be overlooked.

PPR: The infection of PPR in goats in Odisha seemed to be emerging disease. The state of Odisha observed 4 and 15 outbreaks in 2009-10 and 2010-11. The morbidity reported during the period was 14.82 and 12.23 percent. The mortality was, however, 70.49 and 56.00 percent in 2009-10 and 2010-11. During 2009 -10, the outbreaks were observed in eastern ghat and eastern and southern coastal plains, while the pattern was different during 2010-11 where most of the outbreaks were recorded in Northern plateau and west central region.

Table 2: PPR occurrence in Odisha

Year	Out-breaks	No. Animals at Risk	No. of Affected animals	Morbi-dity (%)	Morta-lity (%)
2009-10	4	823	122	14.82	70.49
2010-11	15	3401	416	12.23	56.00

Goat Pox: Occurrence of goat pox has been observed over the year. During 2009-10, a total of 9 outbreaks observed in Odisha were from 7 districts.Similarly a total 5 outbreaks in 2010-11 were from 5 districts which were different from previous year. Occurrence of disease was more common in Sept. Oct. and November. While the morbidity rate of the disease was 9.69 and 25.58 in 2009-10 and 2010-11 respectively, the mortality rate was 34.00 and 39.39 per cent in corresponding years.

Table 3: Goat Pox occurrence in Odisha

Year	Out-breaks	No. Animals at Risk	No. of Affected animals	Morbi-dity (%)	Morta-lity (%)
2009-10	9	2062	200	9.69	34.00
2010-11	5	516	132	25.58	39.39

CCPP: Contagious Pleuro Pneumonia is a highly contagious mycoplasmal infection leading heavy mortality in goats. Occurrence of the diseases has been reported in Odisha. A total of 6 out breaks have been reported during 2009-2011. The morbidity rate in goats was 6.19

percent while the mortality rate varied from 42.54-60.60 percent. The outbreaks were reported from Ganjam, Khurda, Makangiri and Sambalpur and Nayagarh districts.

Brucellosis: Regular monitoring of Brucellosis was done in cattle. However, screening of goats for this disease has never been done. The rose Bengal plate agglutination test is routinely employed.

Arunachal Pradesh

The visit to Arunachal Pradesh resulted in collection of 17 sera samples for laboratory examination. There was no laboratory for disease diagnostic in AP. The samples were processed at Khanapara laboratory. Bacterial disease reported by the directorate was Enterotoxaemia while among the parasitic diseases Fascioliasis was common. There were no specific documentation of goat diseases. Vaccination was practiced for enterotoxaemia only.

GH.3.1 : Modulation of caprine coccidiosis through herbal therapy

D.K. Sharma and Ashok Kumar

Coccidiosis is serious parasitic disease of Ruminants. In goats the coccidian infection is responsible for anorexia, emaciation, diarrhea, stunted growth and delayed maturity. Project under study explore the potential of herbal products to modulate the Coccidiosis status in goats.

Trials were conducted with protype in feed mix and as suspension. In an experiment conducted in NFR&PT Division, a total five groups with 6 goats in each were maintained. They were provided similar pellet feed with chemical anti-coccidial drug (G2), herbal anti coccidialdrug (G3),anti methanogenic substance (G4)and herbalanti coccidialdrug +anti methanogenic substance (G5) and Control (G1) with no drug. The trial was conducted for 3 months and in all total 10 observation on Faecal oocysts count (FOC) were made (every 10 days). Data generated on FOC being skewed in nature was put for log transformation use natural log transformation. The transformed values were analyzed using SAS. Results of the analysis are presented in table.

Table 1 : Overall FOC in different groups

Group	Mean	SE
G1	4.971^{AB}	0.057
G2	5.132^{A}	0.057
G3	5.020^{AB}	0.057
G4	4.871^{B}	0.057
G5	4.978^{AB}	0.057

Table 2 : Overall FOC in different observations

Observation	Mean	SE
OB 1	5.566^{A}	0.080
OB 2	5.225^{AB}	0.080
OB 3	5.075^{BC}	0.080
OB 4	5.191^{B}	0.080
OB 5	4.700^{D}	0.080
OB 6	4.906^{BCD}	0.080
OB 7	4.660^{D}	0.080
OB 8	4.938^{BCD}	0.080
OB 9	4.738^{CD}	0.080
OB 10	4.947^{BCD}	0.080

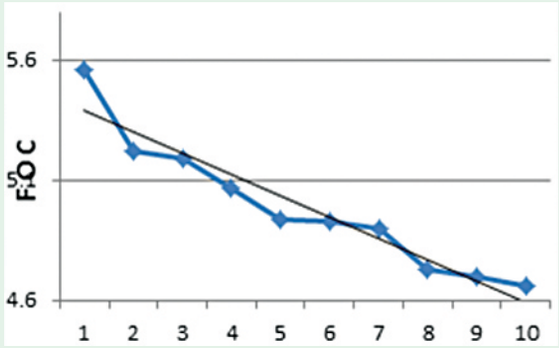


Figure 1 : Observations on Faecal Oocysts count over the period

The SAS analysis of data revealed that there was significant difference in FOC among groups. Group 2 and 4 with chemical anti-coccidial drug and anti-methanogenic substance were significantly different from each other while

Group 1 , 3 and 5 were however similar in FOC. Also the variations in FOC recorded at different intervals were significantand a gradual change in FOC over the period was seen (Fig.1). The interaction between groups X observations was found to be significant. Result analysis of production data of different groups showed highest growth in group with herbal drug when supplemented with anti methogenic compound.

In another trial efficacy of prototype CIRG (ASAR) was tested in *in-vivo* condition using it in suspension form at the dose rate of 10mg/ Kg BW. The Faecal oocysts count was performed on experimental kids pre and post treatment(day 7 and 14 PT). The FOC data was normalized by natural log transformation and statistical analysis(One way ANOVA) was performed on transformed data only. The Result of SAS analysis has been given as under*:*

Day of Treatment			LSM	SE
Pre treatment		FOC	5.747^{A}	0.345
Day 7	PT	FOC	4.808^{AB}	0.345
Day 14	PT	FOC	3.992^{B}	0.345

SAS analysis of transformed data showed that there was significant reduction in LSM of FOC. The pretreatment LSM of FOC i. e 5.747 ± 0.345 lowered down to 3.992 ± 0.345 showing significant reduction.

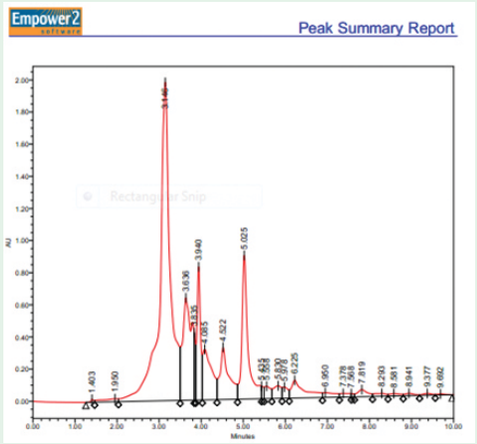


Figure 2 : HPLC Analysis of CIRG-3

Work conducted on chemical analysis of the potentially efficient herbal extracts through HPTLC results are shown as under.

Extract CIRG-3 HPLC chromatograph (Fig.2) showed a total of 41 peaks. Of these, 3 peaks with area 8.19, 10.49 and 10.64 percent corresponding to RT values of 18.23, 26.53 and 23.65 minutes were major peaks. Extract CIRG-7 HPLC chromatograph (Fig. 3) resulted in 23 peaks in total. Of these 3 peaks with total respective areas of 45.13, 12.38 and 11.69 percent corresponding to RT value 3.148, 3.636 and 5.025 minutes were major peaks. Similarly, chromatograph of extract CIRG-9 (Fig.4) showed a total of 12 peaks. Of the 12 peaks, 3 at RT value of 8.792, 2.127 and2.553 minutes with respective area of 19.91, 18.25 and 36.77 percent were major peaks. Information so developed is further being revalidated through experimentation.

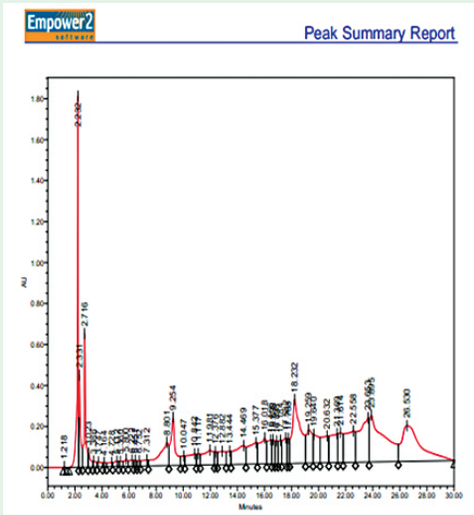


Figure 3: HPLC Analysis of CIRG-7

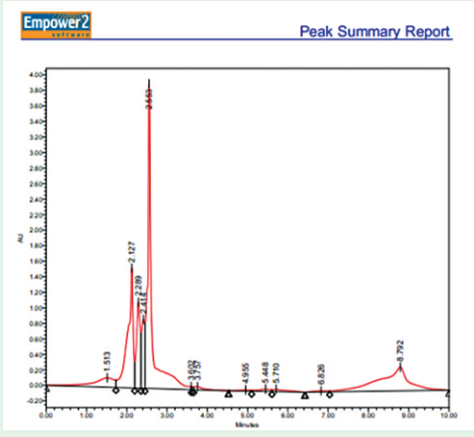


Figure 4: HPLC Analysis of CIRG-9

GH 2.2: Development of herbal antidiarrhoeal drug for goats

Ashok Kumar, V.K. Gupta

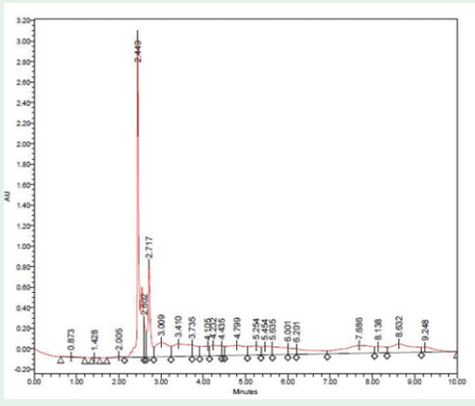
Extraction preparation of selected plants and chemical analysis

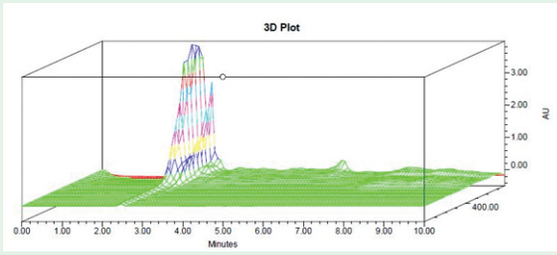
The selected three plants were collected from the local area and were confirmed taxonomically. Methanolic extracts were prepared by soxhlet extraction under low temperature (25-30°C) . The recovery of solvent was done by rotatory vacuum evaporator (Heidolph, Germany) under reduced pressure and temperature (4°C). The concentrated extracts were air dried and stored at 4°C. The selected and effective plants extract under methanolic solvents were studied for antibacterial activity. The percent yield was calculated on as such basis and their physical characteristics were also noted. The percent yield for three extracts varied from 12-20 percent. Qualitative chemical analysis was conducted to verify the chemical constituents for the presence of mainly flavonoids, alkaloids, saponins, Carbohydrates, glycosides, steroids, tannins& phenolic compounds and protein & amino acids by standard methods for the confirmation of chemical ingredients. The CIRG 1 was positive for flavonoids, alkaloids, carbohydrate and triterpenoids and negative for Proteins & amino acids, saponins , steroids and tannins. CIRG 2A chemically composed of carbohydrate, tannins and triterpinoids & phenolics only and CIRG3A was positive for flavonoids, and tannins .

Isolation and characterization of *E coli*:

E. coli isolates were collected from Institute (CIRG) flocks from diarrheic kids . These isolates were characterized by morphological, biochemical and molecular (PCR) methods. Characterized isolates were subjected to in vitro antibiotic sensitivity as per the disc susceptibility method in order to find out the susceptibility and resistance profiles. A total of 18 antibiotics (antibiotic discs from HiMedia) from 9 different groups were used. The E coli organism was resistant to all tested cephalosporins (Cephalexins, Cephadroxil, Ceftriaxone, Cefotaxime, Penicillins (Penicillin G, Amoxicillin, Amoxiclav, Ampicillin, Methicillin), Quinolones (Ciprofloxacin, Norfloxacin, Enrofloxacin, Lomefloxacin), Kanamycin, Tobramycin ,Tetracycline , and Sulphonamide , however, sensitive to Amikacin, Gentamicin, Roxithromycin, chloramphenical and Polimixin.

Standardization of formulations : Standardization of three plant extracts was done by HPLC (Waters) . The chromatogram was developed in mobile phase of Methanol: Water (50:50) , C18 column , 20µl injection volume for 10 minute , unicratic mode at room temperature. In CIRG 1 plant extract (1mg/ml) , 21 peaks were observed, with major peaks at RT (minute) 2.753 (13.84%), 3.035(27.98%), 3.367 (34.02%), 4.237(4.81%) and 4.619(3.91) . In CIRG 2A plant extract (1mg/ml) , 22 peaks were observed , with major peaks at RT (minute) 2.449(24.15%), 2.717(7.76 %), 3.009 (6.55 %),3.810 (7.59%), 4.232(3.77) and 4.799 (6.65). In CIRG 3A plant extract (1mg/ml) , 19 peaks were observed , with major peaks at RT (minute) of 3.257 (22.02%), 3.032 (20.84 %), 8.249 (5.99 %),3.810 (7.59%), 4.232 (3.77) and 4.799 (6.65) .





Peak Summary and chromatogram of Plant Extract CIRG-2A

Therapeutics trials : The formulation of three plants extracts were prepared in gum acacia powder to prepare pulverized powder and tested in clinical cases of diarrhoea kids and goats at the dose rate of 10 mg/kg B.W for 1- 2 days orally and observed degree of recovery (score) and recovery days. In clinical trials, pretreatment values of appetite (Good-1, Low-2, No appetite-3), fecal consistency (Watery-1, Semi solid-2, Loose ball-3, Normal-4) and dehydration (+1, +2, +3, +4) were recorded on score basis . Rectal temperature was recorded in both the groups. Recovery score recorded as (Poor-1, Partial-2, Moderate-3, and Complete 4. In spontaneous nonspecific clinical diarrhea in different age group were treated with anti-diarrhoeal formulation with or without anti-bacterial drug for 1-3 days duration depending upon recovery. The animals responded to therapy.

G.H. 2.1 : Control of Brucellosis in goats by Molecular Diagnosis and Epidemiology

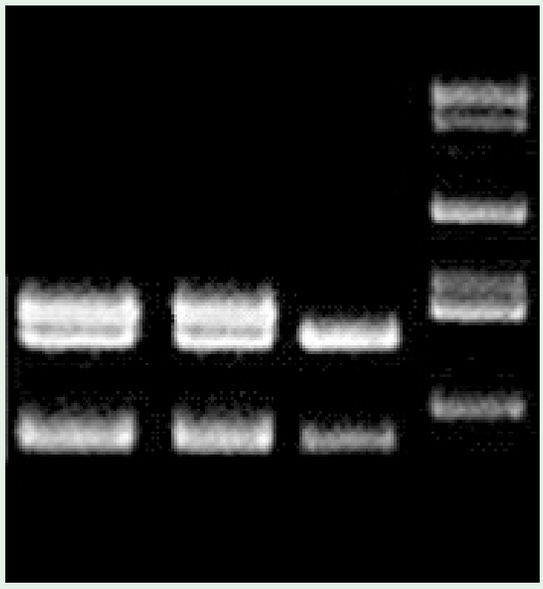
V.K. Gupta, S.V. Singh and V.S. Vihan (upto May 2011), G.B. Manjunatha Reddy (w.e.f. 1.6.2011)

Isolation of Brucella from specimens

A total of 04 suspected *Brucella* isolates were isolated. Theses isolates were further subjected to identification and characterization.

Identification of Brucella organisms

Classical biotyping : *Morphology and Growth characteristics:* Suspected *Brucella* colonies which were close to colonies of contaminants were picked and restreaked on Brucella agar medium. Two isolates were identified as genus *Brucella* For characterizing the *Brucella* at the biovar level four (04) main tests were used: carbon di oxide (CO_2) requirement, production of hydrogen sulphide (H_2S), dye (thionine and basic fuchsine) sensitivity, and agglutination with monospecific A and M antisera.



Agarose gel electrophoresis of restriction digested

(*Pst I*) *omp2* PCR product fragments from isolated *Brucella* strains

*Lane 1, *B. melitensis* strain 16M; lane 2, *B.melitensis* Rev1; lane, 3, *B.melitensis* biovar 3; lanes 4, Standard DNA marker.

PCR-RFLP for molecular typing of *Brucella* culture : A promising molecular approach i.e. PCR-RFLP analysis of *Brucella omp2* gene was used for molecular characterization of suspected Brucella isolates. A total of 09 samples were processed for isolation of Brucella. Out of this a total of 02 suspected *Brucella* isolates were isolated.

Standardization of developed PCR to be used as regular diagnostic test for screening of Brucella cases

Table 1 : Detection of *B. melitensis* by different detection methods in abattoir samples

Tests	Positive	Negative	Total
Tissue PCR	39 (51%)	37 (49%)	76
Blood PCR	41 (54%)	35 (46%)	76
Serology(SAT + d-ELISA)*	29 (38%)	47 (62%)	76

*SAT = Standard agglutination test, d-ELISA= dot-ELISA

Molecular analysis of Brucella gene sequences

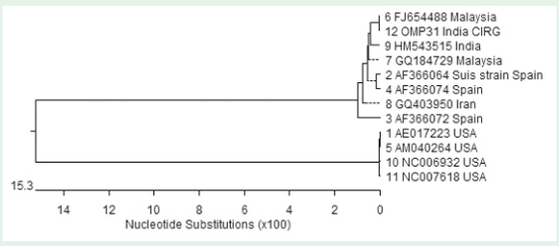
*The gene sequences of B.*melitensis were submitted to GenBank (NCBI) and following accession numbers were obtained.

Table 2 : GenBank accessions : *Brucella melitensis* genes

S. No.	Definition of Genes	Accession numbers
1.	*Brucella melitensis* outer membrane protein 31 (omp31)	JF918757
2.	*Brucella melitensis* outer membrane protein 28 (omp28)	JF918758
3.	*Brucella melitensis* outer membrane protein 25 (omp25)	JF918759
4.	*Brucella melitensis* outer membrane protein 16 (omp16)	JF918760
5.	*Brucella melitensis* periplasmic protein 39 (p39)	JF918761
6.	*Brucella melitensis* 16s rRNA	JN180300
7.	*Brucella melitensis* L7/L12	JF946742

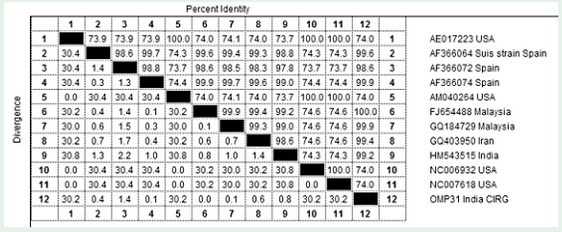
Phylogenetic tree based on Omp31 gene of *B.melitensis*

This analysis of Omp31 gene revealed that CIRG isolate of *B melitensis* belongs to the same clan of Spain, Iran and Malaysia



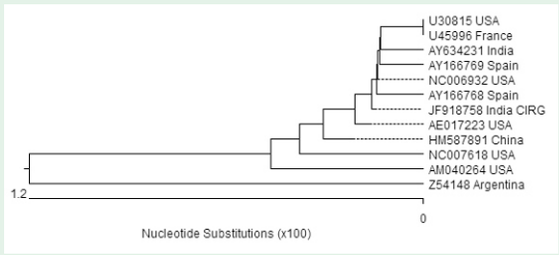
Sequence distance table based on Omp31 gene of *B.melitensis*

Sequence distance analysis based on Omp31 gene revealed that CIRG strain is having matching sequences with Spain, Iran and Malaysia isolates



Phylogenetic tree based on Omp28 gene of *B.melitensis*

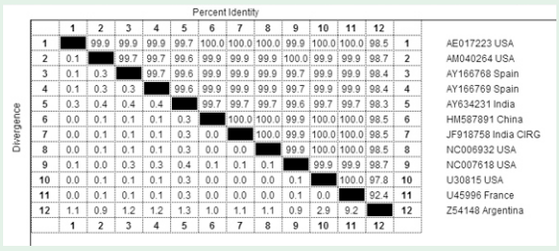
This analysis of Omp28 gene revealed that CIRG isolate of *B. melitensis* belongs to the same clan of as of USA, France, Spain and other strains available in India.



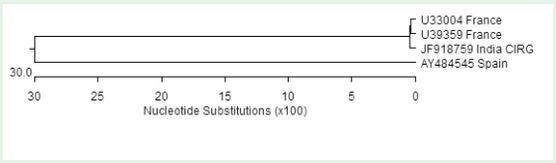
Sequence distance table based on Omp28 gene of *B.melitensis*

Sequence distance analysis based on Omp28 gene revealed that CIRG strain is having matching sequences with of USA, France, Spain and other strains available in India.

Phylogenetic tree based on Omp25 gene of *B.melitensis*



This analysis of Omp25 gene revealed that CIRG isolate of *B melitensis* belongs to the same clan of as of France and Spain isolates.



Sequence distance table based on Omp25 gene of *B.melitensis*

Sequence distance analysis based on Omp25 gene revealed that CIRG strain is having matching sequences with of France and Spain isolates.

Percent Identity

Divergence	1	2	3	4		
1		17.6	24.3	17.8	1	AY484545 Spain
2	60.1		99.2	99.2	2	JF918759 India CIRG
3	60.1	0.8		99.3	3	U33004 France
4	60.1	0.8	0.7		4	U39359 France
	1	2	3	4		

Development and characterization of indigenous vaccine and diagnostics for Johne's disease (CSIR/XI/01, PPP mode)

S.V. Singh

Whole Genome Sequencing : 'Indian Bison type' MAP strain 'S 5' used in making 'ELISA kits' and 'Vaccine' is under whole genome sequencing at Genotypic (P) Ltd., Bengaluru.

Differentiation of Infected and Vaccinated Animals (DIVA) : JD vaccine is free from cultural filtrate proteins (CFPs) or secretary proteins, hence vaccinated animals produce antibodies against structural proteins whereas infected animals, both against structural and secretary proteins (CFPs). CFPs will be cloned in pET22b+ vector as His-tagged (C- terminal) fusion protein and will be purified by Ni-NTAAgarose affinity chromatography. Resulting recombinant protein will be used as tapping antigen in ELISA. Of 14 CFPs, six (MAP 1693c, MAP 1693c, MAP 2168c, MAP Mod D, MAP 85c, Pep AN, Pep AC) known to induce detectable antibodies will be used to establish a profiling ELISA.

Cloning: Primers for PCR amplification of MAP 1693c, MAP 2168c, MAP-Mod D, MAP-85c, MAP-Pep AN, MAP-Pep AC genes were developed..

Amplification of MAP *1693c* and *Pep AC* gene.

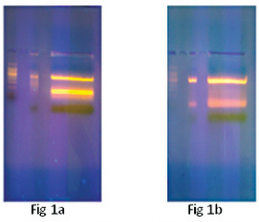


Fig 1a Fig 1b

MAP *1693c* and *Pep AC* gene amplified in PCR. 50ng of template DNA (MAP) and 10 pico-moles of primers were used in 20 ul of reaction volume with Green master mix (Promega). Fig 1a depicts the MAP *1693c* specific gene product in 2% agarose gel (anealing at 64°C). Fig 1b depicts *Pep AC* specific gene product (anealing 55°C)

Fig. Amplification of MAP 1693c and Pep AC gene

Competent cell preparation: Single colony of DH5á cells was inoculated into 5 ml Luria broth and grown overnight. Starter culture was used to inoculate 100 ml LB media and grown at 37^0 C till OD reached 0.4 to 0.6. Culture was centrifuged at 3000 rpm for 10 min at 4°C. Pellet resuspended in 25 ml ice chilled 0.1 M $CaCl_2$ and incubated on ice for 30 min. Cells centrifuged at 3000 rpm for 10 min at 4°C and washed twice with 10 ml of 0.1 M $CaCl_2$. Pellet resuspended in 900 µl of 0.1 M $CaCl_2$ containing 20% glycerol and made 100 µl aliquot in 1.5 ml tube and kept the cells in -20 °C.

Transformation of DH5á competent cell from pET-22b (+) vector plasmid: DH5á competent cells taken from -20°C were thawed at 4°C for 10 min. pET-22b (+) vector plasmid (containing 100 ng DNA) added and incubated for 20 min in ice. Cells were subjected to heat-shock at 42°C for 45 to 60 sec followed by chilling on ice for 5 min and 1ml LB media was added and incubated at 37°C on 150 rpm for 2 hr. About 100 ul and 200ul culture was spread on ampicillin (100 µg/ml) containing Luria Bertani agar plate and incubated at 37°C overnight.

'Indigenous Vaccine' for Johne's disease

Qualitative and Quantitative composition: JD being highly endemic in domestic ruminants, earlier dose of 2.5 mg/ml/animal was insufficient for life time. Therefore, new vaccine batches were prepared with 5 mg/ml concentration of MAP bacilli. In cattle

revaccination was needed to boost immune response as shedding of MAP increased after 360 days in animals maintained on poor nutrition levels (wheat straw). In re-vaccinated animals shedding and diarrhoea stopped.

Adjuvant: Vaccine is suspension of Mycobacterium avium subspecies paratuberculosis (MAP) 'Indian Bison type' strain (S 5) grown on HEYM and heat inactivated (720C for 2 hr) and adjuvant (#3022 from GERBU Biotechnik GmbH, Gaiberg, Am Kirchwald, Germany).

Product: 'Indigenous Vaccine' was both preventive and therapeutic against JD in goats, sheep, cattle and buffaloes and can also be used in deer and other wild life animals.

JD vaccine submitted to Standardization Division (IVRI): The 120 doses of 'Indigenous vaccine' (5 mg/ml in Gerbu adjuvant) dossier of characteristics of 'Vaccine strain' were transferred to Standardization Division of IVRI for comparative studies with TANUVAS, vaccine.

Test Protocols for JD vaccine (not available in IP vet): On the request of Standardization division, IVRI, the extensively evaluated 'Test protocols' in goats, sheep and cattle ('Challenge' & 'Therapeutic' model) at CIRG, Mathura, Dantiwada, Mannavanur, etc., since 2005 were submitted and a chapter for IP vet is being written for IP Vet, for the first time in India

Commercialization of 'ELISA kit': Extensively evaluated 'Indigenous ELISA kit' developed by CIRG, Makhdoom, was given to National Research Development Council, New Delhi for commercialization and Biovet (P) Ltd., proposed to purchase it for commercialization.

Prevalence of Johne's disease: Five tests were used to estimate prevalence in herds and flocks from different geographical regions. Of 322 samples from goats, sheep and cattle (CIRG, Mathura, Rajasthan, Bharatpur, Bengaluru), prevalence by ELISA kit was (52.9%) as compared to fecal microscopy (36.0%), milk microscopy (29.4%), tissue microscopy (28.8% in intestine and 23.7% in MLN), blood PCR (14.8%) and tissue PCR (5.4% in intestine and nil in MLN).

Table 1: Prevalence of MAP infection in herds and flocks

Region	Species	Tests	Sample (n)	Positive (n)	Prevalence (%)
CIRG, Mathura, Rajasthan, Bengaluru	Goats, sheep, cattle	Fecal microscopy	322	116	36.0
		ELISA kit	310	164	52.9
		Blood PCR	108	16	14.8
CIRG, Makhdoom	Goat	Milk microscopy	22	5	29.4
CIRG, Makhdoom	Goat & Sheep	Tissue microscopy Intestine & MLN	192	33	17.18

*Serum samples in 'strong positive' and 'positive' category in ELISA were considered as positive

Table 2: Comparative analysis of fecal microscopy, blood PCR and serum ELISA

Tests	Combinations							
	1	2	3	4	5	6	7	8
Fecal microscopy	+	-	+	-	-	+	-	+
Blood PCR	+	-	-	+	-	+	+	-
Serum ELISA	+	-	-	-	+	-	+	+
N=85	12	29	4	0	19	0	0	21

*Irrespective of species, including goats, sheep and cattle samples

Suspected farm goats (CIRG, Makhdoom):

Fecal samples: Of 17 fecal samples from Barbari, Jamunapari and Jakhrana goats suspected for clinical JD, 5 (29.4%) were positive.

Tissues: Screening of tissues (Intestines and Mesenteric lymph nodes) of 22 goats and sheep necropsied, 13 (59.0%) were positive for presence of acid fast bacilli, irrespective of cause of death.

Weak young Jamunapari goats: Of 22 weak goats, 16 (73 %) and 2 (13%) were positive in fecal microscopy and ELISA, respectively.

Adult weak Jamunapari goats: Of 11 goats, 8 (73.0 %) were positive for MAP. Whereas, 3 (27.0 %) and 9 (82.0 %) were positive in IS 900 PCR and serum ELISA, respectively.

Weak Barbari goats: Of 25 weak goats, 16 (64.0%) and 8 (32.0%) were positive for MAP by microscopy and ELISA, respectively.

Suspected farm goats (Private herds)

Sirohi goats from Popa Burz, Farah: Of 34 goats, 31(91.18%) were positive by ELISA.

Young Jamunapari males from Kumher, Bharatpur: Of 9 goats, 3 were positive by fecal microscopy.

Young goats from Biovet, Bengaluru: Of 12 goats, 9 and 6 were positive by microscopy and ELISA, respectively.

Farmer's goats (Sirohi), Rajasthan: Of 46 young Sirohi goats purchased from native tract in Rajasthan (1st lot), 18 (39.1%) and 16 (34.8%) were positive in fecal microscopy and ELISA, respectively, Of the 34 total goats positive in two tests, 26 were detected individually by two tests. Of 83 goats (2nd lot) sampled, 8 (9.6%) were positive by fecal microscopy.

Screening of cattle

Suspected calves from Biovet, Bengaluru: Of 17 calves, 9 (52.9%) were positive by microscopy, IS900 PCR and ELISA, except ILN 0278861, which was positive both in PCR and ELISA.

Farmcattle from Himanchal Pradesh: Of 69 cattle serum received from HP, 46 (66.0%) were positive by ELISA kit.

Adult healthy Sahiwal cows and bulls (Janmbhoomi, Mathura): In 1st sampling on 20.01.2012, of 10 cattle, 5 and 3 were positive in microscopy and ELISA, respectively. In 2nd screening of 34 cattle, 5 (15.0%) were positive by ELISA.

Validation of 'Indigenous ELISA kit': Samples (Feces, blood, serum and tissues from intestine and mesenteric lymph nodes) from sheep and goats sacrificed after 'feedlot experiments' at CIRG, Makhdoom were used for validation of ELISA kit. Thorough physical examination was conducted before and after skinning and for live body weights etc. Samples were screened by microscopy, IS900 PCR and ELISA kit. 'Indigenous ELISA kit' will be compared. Histopathology findings will be taken as 'Gold standard' for evaluation of ELISA kit.

Muzaffarnagri sheep: Samples (fecal, blood, serum and tissues) of acrificed sheep were tested by microscopy, IS900 blood PCR, ELISA and histo-pathology. Comparison of different tests with histo-pathology is under way. Sheep were found to be less susceptible to MAP infection.

Barbari goats: Fecal, blood, serum and tissues were screened by fecal microscopy, IS900 blood PCR, ELISA and histo-pathology. Comparison of different tests with histopathogy is under way. Barbari goats were highly susceptible to MAP infection.

Validation of 'Indigenous Johne's Disease Vaccine': Of 9 trials 'Indigenous Johne's Disease Vaccine' only 7 continued. A experimental trial in goat kids for limited time was concluded. A trial in cattle (Swadeshi Goshala) was discontinued in 2010. Eight trials (3 cattle, 3 goat and 2 sheep) were available for monitoring. Trials were conducted on 'spontaneous cases of JD (50-75% clinical cases). Major limiting factor was extremely poor health and nutrition. Nutritional status of the sheep flock at Mannavanur, TN and a cow herd (Vaishnav Goshala at Vrindavan was optimum. In JD stress factors directly affect animal productivity and response to vaccination, which is directly

related to diversion of energy for fighting diseases etc.

Trial I (Goats, CIRG, Makhdoom): A new trial was started with 5mg/ml concentration in Animal Health shed. Young goats from poor in body condition scores with clinical symptoms of JD were randomly divided in 3 groups (Vaccinated with new and old batch of vaccine and control group given 1 ml of PBS. Goats were monitored for response to vaccine.

Monitoring of Vaccine response by fecal microscopy, blood PCR and ELISA: Fecal microscopy showed no change (16.9%) in MAP shedding in adjuvant group. Shedders decrease (16.7%) in new vaccine group, there was no change in old vaccine and increase (3.6%) in control group from 0 to 150 dpv. Result of blood PCR showed decrease in bacterimia in new vaccine group upto 150 DPV and increase in control group.

Monitoring of humoral immunity: ELISA titer showed gradual increase in 'new' and 'old' vaccine groups and was varying in 'control group' upto 150 dpv.

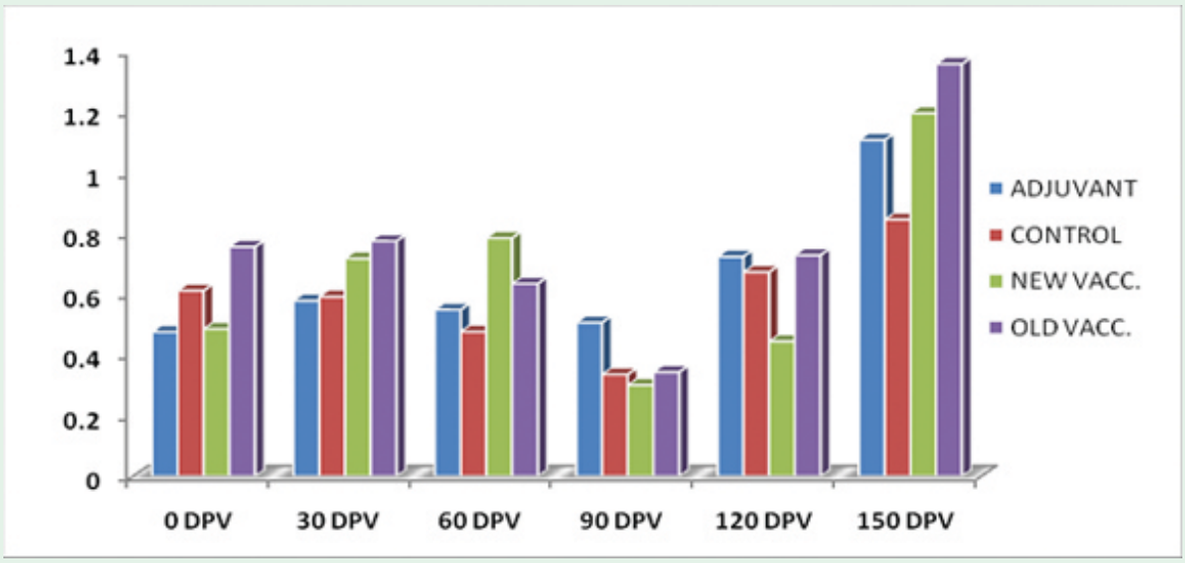


Fig 2: Sample to positive ratio in different groups of animals from zero to 150 dpv

Body weights: Body weights were recorded at weekly and monthly intervals upto 2 months.

Females: Average body weights gained (within a year of vaccination) in vaccinated and control group were analyzed statistically. Though values passed 'normality test' (P value > 0.1) however, vaccinated sheep gained more weight as compared to control.

Table 4: Statistical analysis of average body weight gained

Days post vaccination	Body weights (Kg ± SE)			
	Adjuvant(N= 6)	Old vaccine (N=7)	New vaccine (N=8)	Control (N=8)
0 DPV	23.1 ± 3.1 (N=6)	23.5 ± 3.4 (N=6)	20.4 ± 2.3 (N=8)	24.5 ± 2.0 (N=8)
30 DPV	22.8 ± 1.5 (N=6)	24.8 ± 2.5 (N=7)	21.0 ± 1.8 (N=7)	24.5 ± 2.0 (N=8)
60 DPV	24.2 ± 0.9 (N=6)	25.0 ± 2.3 (N=7)	21.7 ± 1.7 (N=7)	24.2 ± 1.6 (N=8)
90 DPV	24.6 ± 1.8 (N=5)	23.3 ± 2.0 (N=6)	19.9 ± 1.9 (N=6)	22.6 ± 2.4 (N=5)
120 DPV	25.6 ± 2.2 (N=5)	23.3 ± 1.9 (N=6)	22.5 ± 2.5 (N=4)	22.7 ± 1.7 (N=7)
150 DPV	27.8 ± 2.1 (N=6)	29.6 ± 2.4 (N=7)	25.2 ± 1.2 (N=6)	23.9 ± 1.2 (N=6)
AWG (kg)	**4.70**	**6.10**	**4.80**	**- 0.60**

AWG: Average weight gained

Table 5: Experimental MAP-S5 vaccine testing in goat and sheep

Animals	Species	Sex	Age(m)	Body wts..		Microscopy			IS900	ELISA	ELISA
				0 dpv	30 dpv	0 dpv	30 dpv	60 dpv	PCR	0 dpv	30 dpv
STG 001	Goat	FM	-	-	-	2+	2+	2+	Neg	Pos	Neg
STG 002	Goat	FM	11	28.7	30.5	3+	1+	1+	Neg	Neg	Neg
STG 003	Goat	FM	15	21.1	26.1	1+	1+	1+	Neg	Neg	Neg
STG 004	Goat	FM	15	25.3	28.8	2+	1+	1+	Pos	Pos	Neg
STG 005	Goat	FM	17	21.0	22.4	1+	1+	Neg	Neg	Neg	Neg
STG 006	Goat	FM	-	-	-	Neg	NA	NA	Neg	Pos	Pos
STG 007	Goat	FM	-	-	-	2+	NA	NA	Pos	Pos	NA
STG 008	Goat	FM	17	16.2	17.5	Neg	1+	Neg	Neg	Pos	Pos
STG 009	Goat	FM	18	13.2	14.2	1+	1+	1+	Neg	Pos	Neg
STG 010	Goat	FM	-	-	-	Neg	NA	NA	Neg	Neg	Neg
STG 011	Goat	FM	18	15.1	16.0	1+	1+	1+	Neg	NA	Neg
STS 001	Sheep	M	17	35.8	40.5	Neg	Neg	Neg	NA	NA	NA
STS 002	Sheep	FM	14	**	**	2+	2+	2+	NA	NA	NA

*NA- Samples not received, ** Pregnant

Trial II (Goats, Biovet, Malur) New trial

Animals: Goats (14) and sheep (2) purchased from local market at Biovet were used in trial.

Vaccination: 'Indigenous vaccine' (1 ml) was inoculated subcutaneously in 14 goats and 2 sheep (>3 months old). Temperature and body weights we recorded and goatsraised on grazing. Fecal, blood and serum collected at zero and 30 dpv and screened.

Monitoring of old trials

Trial' III (Mehsana goats, Dantiwada, Gujarat): Representative 52 goats (Male-15 and Female-37) of 250 naturally infected Mehsana goats (LRS, SDAU) maintained on grazing (pasture extremely deficient in nutrients) were monitored (vaccinated =37 and control =15) for vaccination response (immune titer and body weights) and sampled at monthly interval. Kids born to vaccinated goats were vaccinated on 26.3.2011.

Status of MAP infection at zero day : Of 52 goats, 28.0, 43.3 and 7.6% were positive in microscopy, indigenous ELISA and blood PCR, respectively.

Monitoring of vaccine response : (Microscopy, ELISA and blood PCR**):** There was gradual reduction in shedders in vaccinated goats as compared to control. Antibody titer of vaccinated goats was up-regulated after vaccination and peaked at 60 DPV and declined slightly afterwards but was still significantly above control group. Titer of goats in control group also raised with vaccinated ones but was significantly lower at each sampling. Up-regulation in control group may be due to Ivermectin injection given to goats at the time of vaccination. Ivermectin is known non-specific immune stimulator. Indigenous ELISA kit' do not discriminate between infected and vaccinated goats therefore, assessment of vaccine mediated immune response in already infected goat may be of random type or unpredictable.

Body weights: Vaccinated goats gained significantly higher weights (p= 0.038) as compared to control (vaccinated goats gained 2.61±0.52, while control lost weight =0.54±1.57 kg when compared with weights on the day of vaccination.

Mortality: A control goat died 3 months after vaccination and was very weak. It had clinical symptoms of JD and was positive for MAP infection in all the three tests.

Other improvements: Physical condition of the goats improved after vaccination. There was regeneration of hairs and looked healthier due to deposition of fat in visceral organs. Body coat gained lustre, pliability, were alert and active. In-contact goats also improved. Birth weight of kids born to vaccinated goats was better than of control goats.

Lesson's accrued: In different monitoring parameters positive effect of vaccine were recorded within 5 months. Due to low nutritional inputs improvement was slow and not drastic as in trials, where goats received heavy inputs (concentrate, green fodder, lopping, dry fodder and 6-8 hr grazing). Goats developed 'heavy takes' which re-sorbed within 5 months of vaccination. Vaccine was safe as no un-towards reaction was seen in any of vaccinated goats. Size of 'take' (a dispersed swelling at the site of injection) was large as compared to other trials.

Trial IV: Patanwadi sheep, LRS, Dantiwada): After success of trial in Mehsana goats, new trial was taken up in sheep flock. Of 132 sheep, 110 were vaccinated and 22 were controls.

Monitoring of Vaccine response: Flock was vaccinated (110 vaccinated and 22 controls) on March, 2011 and monitored for improvements (diarrhoea stopped, mortality and morbidity reduced, fecal shedding reduced). Vaccinated sheep sero-converted and no animal was reported in sickness despite heavy rainfall. 'Indigenous vaccine' against JD was 'therapeutic' as clinically sick sheep were cured of JD.

Status of shedding of MAP: Fecal samples profile of shedding of MAP at zero day and 90 DPV showed reduction in number of shedders both in vaccinated and controls (trend was better in vaccinated group). Improvement in control group may be due to reduced contamination of environment (soil and pasture) by vaccinated sheep and daily dose of MAP was reduced in control group. Trial in Patanwadi sheep continued and newly vaccinated lambs (42 vaccinated on Dec, 2011) were monitored.

Vaishnav Gaushala, Bansivat, Vrindavan: Animals (36) were monitored for physical appearance and by microscopy, blood PCR and serum ELISA

Govind Gaushala, Akrur, Vrindavan

Animals: In this trial cattle herd was maintained on low plane of nutrition. Body condition of 680 cows under study was variable (healthy to weak, debilitated and emaciated) and majority were sub-clinical to clinical cases of JD. Cows (41 calves and 639 adults) were randomly divided in vaccinated and control groups and 532 (31 calves and 501 adults) were vaccinated and 148 (10 calves and 138 adults) were controls and representative cows were regular monitored and sampled by ear tagging.

Prevalence of MAP at zero day: Screening of 121 blood, 63 serum and 103 feces revealed 42.2, 54.0 and 28.2% positive in microscopy, ELISA and blood PCR, respectively.

Monitoring of vaccine response: ELISA was performed at 0, 30, 90, 210, 270 and 360 DPV, blood-PCR 0, 30, 210, 270 and 360 DPV. Reduction in MAP shedding (10.8%) was recorded in vaccinated cattle,. Increase of 1.7% was also recorded in controls after a year.

ELISA titer: Comparison of ELISA at 0, 30, 90, 210, 270 and 360 DPV, showed peak at 90 DPV, whereas at 30 DPV there was no difference. Both vaccinated and control cows had up-regulated anti-MAP antibodies as compared to 0 DPV. Up-regulation of sero-titer may be due to cumulative effect of Ivermectin injected simultaneously with vaccine and pre exposure or natural infection of cows. Ivermectin boost up general immune health, and memory cells direct production of antibodies against MAP.

Blood-PCR: It showed 17.1% reduction of presence of MAP in PBMCs in vaccinated cows, whereas there was 28.3% increase in bacterimia in control cows at 360 DPV.

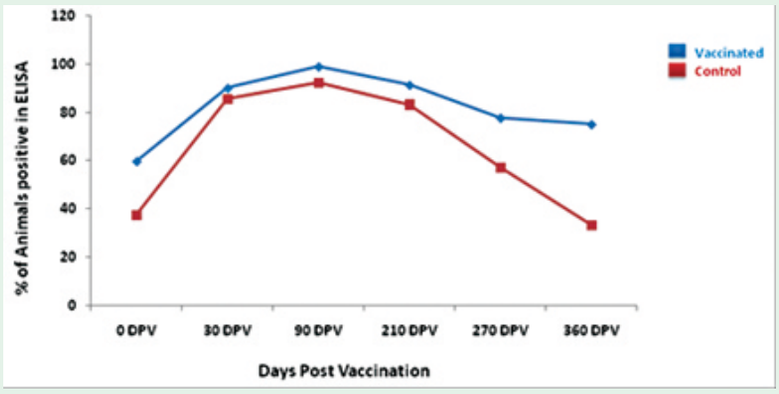


Fig 9: Per cent positive animals in ELISA at different time interval post-vaccination:

Lessons Accrued: Unrestricted breeding of cows was a constrain in the study. Improvement in vaccinated cows was visible and appetite of cows improved. There was no case of diarrhea in the vaccinated cows during trial.

Veterinary type culture-Veterinary microbes (ICAR Network project)

V.K. Gupta and G.B. Manjunatha Reddy,

Isolation of *Staphylococcus* spp. from cases of Clinical and sub-clinical mastitis

In the study, period of lactation was selected and milk samples were collected for screening intra-mammary infection in different dairy goats. During this study 14 different isolates belonging to various groups of *Staphylococcus* spp. were isolated and characterized. Based on the biochemical and molecular tests, the isolates were classified as

Staphylococcusaureus

***Staphylococcus* spp – Coagulase positive**

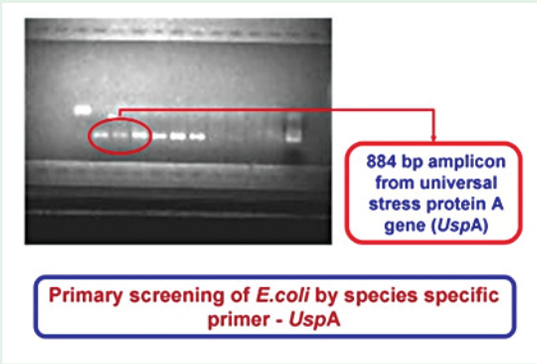
Coagulase negative *Staphylococcus* spp (CNS)

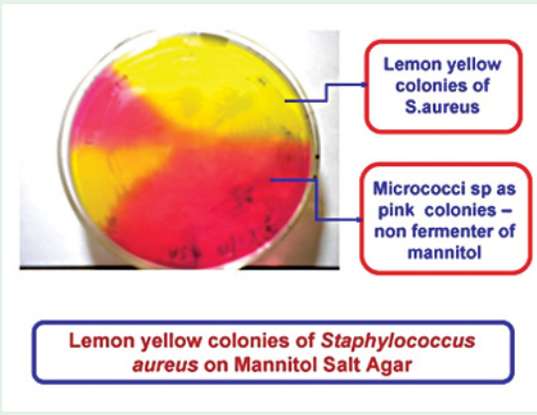
Polymerase chain reaction (PCR) Protocol for *Staphylococcus spp*

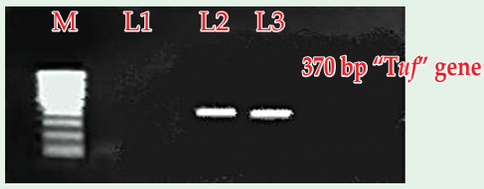
Primers used for amplification *ofStaphylococcus spp.*

Forward 5′- GGC CGT GTT GAA CGT GGT CAA ATC A-3′

Reversed 5′-TTA CCA TTT CAG TAC CTT CTG GTA A 3′







M – 100 bp DNA ladder

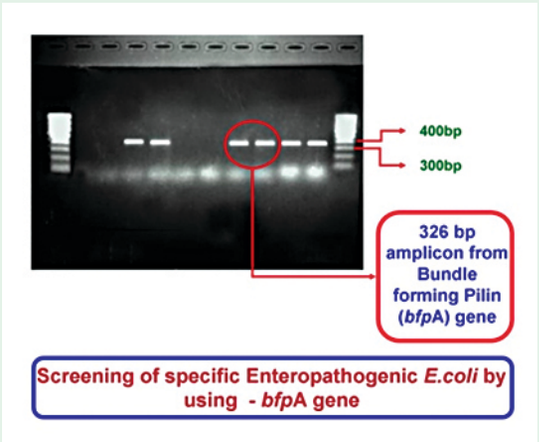
L1-control, L2, L3 – positive for 370bp amplicon

List of cultures submitted by CIRG, U.P.

S.No.	Date of arrival to VTC	Depositor ID	Name of the bacteria
1	28082010	CIRG1	*Escherichia coli*
2	28082010	CIRG2	*Staphylococcus* spp.
3	28082010	CIRGP1	*Brucella melitensis*
4	28082010	CIRGP2	*Brucella melitensis*
5	01022011	Bme/3/CIRG	*Brucella melitensis*
6	01022011	Bme/4/CIRG	*Brucella melitensis*
7	01022011	Bme/5/CIRG	*Brucella melitensis*
8	01022011	Bme/6/CIRG	*Brucella melitensis*
9	01022011	St/195D/CIRG	*Staphylococcus* spp
10	01022011	St/198A/CIRG	*Staphylococcus* spp
11	01022011	St/249A/CIRG	*Staphylococcus aureus*
12	01022011	St/249B/CIRG	*Staphylococcus aureus*
13	01022011	St/276C/CIRG	*Staphylococcus aureus*
14	01022011	St/345B/CIRG	*Staphylococcus aureus*
15	01022011	St/345B/CIRG	*Staphylococcus aureus*
16	01022011	*Staphylococcus aureus* phage/2/CIRG	*Staphylococcus aureus* phage Virus
17	01022011	Indicator *Staphylococcus aureus* phage/1/CIRG	*Staphylococcus aureus* phage Virus
18	01022011	Indicator *Staphylococcus aureus* phage/2/CIRG	*Staphylococcus aureus* phage Virus
19	01022011	*Staphylococcus aureus* phage/1/CIRG	*Staphylococcus aureus* phage Virus
20	17032012	LM1/CIRG	*Listeria monocytogenes*
21	17032012	LM2/CIRG	*Listeria monocytogenes*
22	17032012	LM3/CIRG	*Listeria monocytogenes*

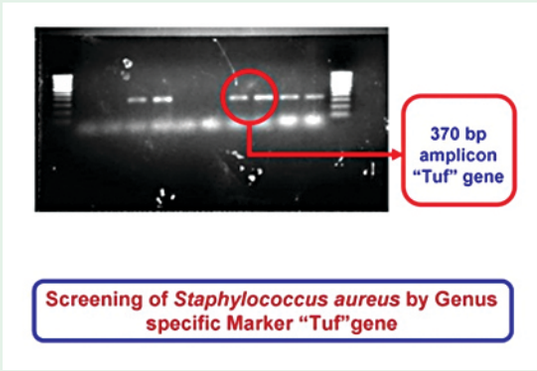
Isolation of *E.coli* from a clinical case of Neonatal diarrhea

Fecal swab was collected from a kid suffering with acute neonatal diarrhea. Primary culture was done on Blood agar and macConkey's agar simultaneously. Molecular characterization was done primarily by using species specific marker, Universal stress protein A gene(uspA), which produced an amplified product of size 884 bp. Later it was tested for enteropathogenicity by using the Bundle forming pilus gene (bfpA), by



using PCR *Staphylococcus* isolate obtained from Goat milk

Milk sample was obtained from a Lactating doe, and the milk was tested for the Somatic cell count (SCC) using direct microscopic method, and simultaneous ulture in Nutrient agar



Screening of *Staphylococcus aureus* by Genus specific Marker "Tuf"gene

Classical biotyping of Brucella cultures

It is important to establish species and biovar of Brucella isolates. Species identification was done based on two main sets of properties: lysis by phages and oxidative metabolic profile on selected amino acid and carbohydrate substrates. For characterizing the Brucella at the biovar level four (04) main tests were used: carbon di oxide (CO2) requirement, production of hydrogen sulphide (H2S), dye (thionine and basic fuchsine) sensitivity, and agglutination with monospecific A and M antisera. The characteristics of Brucella isolates as revealed by the routine typing tests are presented in table 1. There are a large number of bacteriophages active upon members of the genus Brucella, that have not been shown to lyse bacteria of other genera and thus are of taxonomical value for identification at both genus and species level. In present study important phages like Tb, Wb, Bk2, Fi, Iz were used for phage typing.

Outreach Programme on Zoonotic Diseases (ICAR:IVRI-CIRG)

S.V. Singh, Naveen Kumar

Serological and molecular prevalence of Mycobacterium avium subspecies paratuberculosis infection in human population of Mathura region

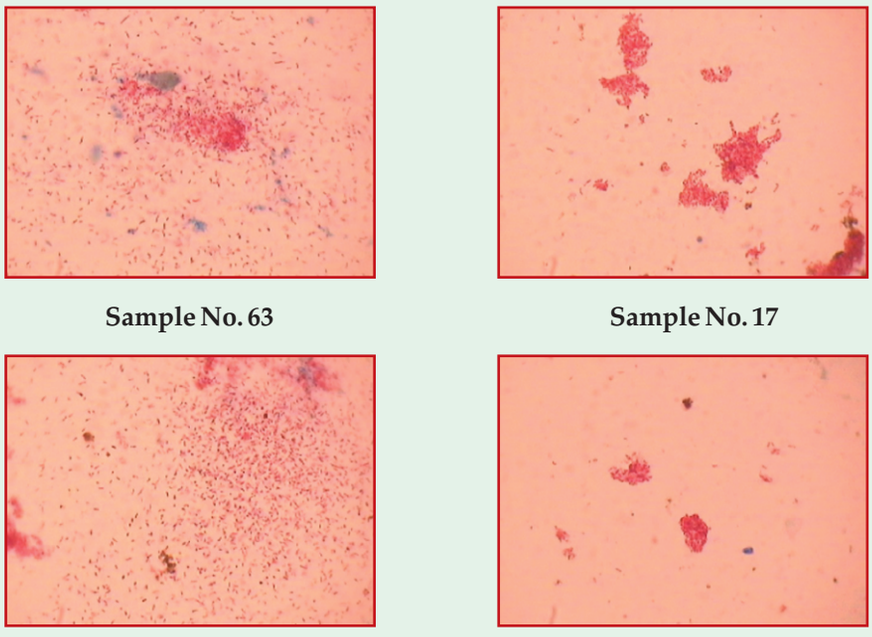
In the first large scale screening of human population of the Mathura region, a total of samples were collected to estimate the presence of Mycobacterium avium subspecies paratuberculosis (MAP) infection. These samples (sera and blood) were submitted to different diagnostic laboratories located mainly in Mathura city and some from Agra city for different patho-physiological conditions. A total of 24,000 samples (serum, blood, and stool) were collected in 404 days (23rd Dec 2010-14th June 2011 & 25th Aug 2011-10th April 2012). from 16 pathology laboratories located in Mathura (7) and Agra (9) cities representing Agra-Mathura region of South U.P.

Serological prevalence: Samples were screened using IS900 PCR, indigenous ELISA kit and microscopy. Of the 18031 sera samples screened, 7.0 and 27.0% were detected as strong positive and positive reactors against MAP infection in ELISA test. Of the various patho-physiological conditions for which samples were submitted, 16.6, 12.7, 16.4, 8.4, 9.3, and 4.4% with respect to ion imbalance, tuberculosis, inflammatory condition, typhoid, anemia and diabetes were found positive for MAP antibody by ELISA kit. Whereas, 20.0, 17.8, 10.2, 7.4, and 4.1% with respect to skin disorder, malaria, blood groups, liver disorder and diabetes were positive in IS900 PCR. Of the 101 stool sample processed 5.9 and 2.9% were positive by microscopy and IS900 PCR.

Molecular prevalence: Of total 3028 samples from Mathura region (Agra and Mathura districts), 8.4% (255) were positive for MAP infection in specific IS900 blood PCR, confirming the contamination of people. Prevalence of MAP was significantly higher in blood PCR as compared to ELISA test and in so called normal serum samples.

Table 1: Screening of human sera samples for MAP infection by ELISA vis a vis other disease conditions for which samples were submitted to pathology laboratories in Agra-Mathura region of South U.P.

Clinical profile of sera samples submitted to pathology labs	Serum ELISA						
	Samples screened *n*	**Strong Positives (SP) *n* (%)**	**Positives (P)*n* (%)**	**Positives (SP+P)*n* (%)**	**Low Positives (LP) *n* (%)**	**Negative (N)*n* (%)**	**Suspected (S)*n* (%)**
Non-infectious health problems							
Lipid Profile	211	1 (0.4)	98 (46.4)	99 (46.9)	38 (18.0)	41(19.4)	33(15.6)
Diabetes	8368	370 (4.4)	1914 (22.8)	2284 (27.0)	1755 (20.9)	2671 32.0)	1658 (19.81)
Liver disorder	1315	113 (8.59)	483 (36.73)	596 (45.32)	238 (18.1)	253 (19.2)	228 (17.34)
Anemia	2025	189 (9.3)	577 (28.4)	766 (37.8)	374 (18.4)	444 (21.9)	441 (21.8)
Serum Urea etc.	190	16 (5.4)	35 (18.4)	51 (26.8)	29(15.3)	89(46.8)	21(11.0)
Thyroid Dis.	2649	135 (5.0)	623 (23.5)	758 (28.6)	618 (23.3)	621 (23.4)	652 (24.6)
Ion Imbalance	632	105 (16.6)	286 (45.2)	391 (61.8)	76(12.0)	109(17.2)	56(8.9)
LH, PRL	41	3 (7.3)	15 (36.5)	18 (43.9)	7(17.0)	9(21.9)	7(17.0)
Sub-Total	**15431**	**932**	**4031**	**4963**	**3135**	**4237**	**3096**
Infectious diseases							
Typhoid	2146	180 (8.4)	748 (34.9)	928 (43.2)	386 (18.0)	429 (20.0)	403 (18.8)
Tuberculosis	243	31 (12.7)	61 (26.0)	92 (37.9)	66 (27.2)	40 (16.5)	45 (18.5)
Inflam. illness	122	20 (16.4)	30 (24.6)	50 (41.0)	28 (23.0)	23 (18.9)	21 (17.2)
Others	89	20 (22.5)	31 (34.8)	51 (57.3)	17 (19.8)	15 (16.9)	6 (6.8)
Sub-Total	**2600**	**251**	**870**	**1121**	**497**	**507**	**475**
Total	**18031**	**1183 (6.5)**	**4901 (27.1)**	**6084 (33.7)**	**3632 (20.14)**	**4744 (26.3)**	**3571 (19.8)**



Sample No. 63 **Sample No. 17**

Sample No. 62 **Sample No. 71**

Fig 1: Acid fast staining of human stool samples positive for MAP

Screening of stool samples: Of the total 101 fecal samples screened from Agra city, 7.1% were positive in microscopy. Of these 6 stool samples were positive in microscopy and specific IS900 fecal PCR, respectively, confirming the contamination of people acid fast MAP.

District-wise prevalence of MAP: Of total 21294 samples from Mathura region (Agra and Mathura districts), 29.7% (6339) were positive for MAP infection. In sero-surveillance, the incidence of MAP was significantly higher in Mathura district, which may be due to differences in class of people (Agra is urban city whereas Mathura is rural type), indicating more chances of association with animals.

Sex-wise prevalence of MAP infection in Agra and Mathura districts of South U.P.: Sex-wise there was no difference in susceptibility to MAP infection.

Age-wise prevalence of MAP infection: Young (0-12 years) and old people showed more susceptibility to MAP infection.

Year-wise profile of clinical samples and prevalence of MAP infection in human population: Over the years profile of clinical samples show increase in incidence of chronic ailments (infectious or non-infectious) and also increase in prevalence of MAP infection.

Table 2: Presence of MAP infection by IS*900* PCR and profile of human blood samples

Sample Profile	IS*900* Blood PCR	
	Samples (*n*)	Positives *n* (%)
Non-infectious health problems		
1. Lipid Profile	121	5 (4.1)
2. Diabetes	435	18 (4.1)
3. Anemia	724	35 (4.8)
4. Liver disorder	67	5 (7.4)
5. Serum Urea etc.	70	0 (0)
6. Thyroid Disorder	57	0 (0)
Sub Total	1474	63 (4.2)
Infectious diseases		
7. Typhoid	30	2 (6.6)
8. Tuberculosis	10	0 (0)
9.VDRL, TORCH)	16	0 (0)
10. Skin disorder	5	1 (20.0)
11. Malaria	56	10 (17.8)
Sub Total	117	13 (11.1)
Others		
12. Blood grouping	196	20 (10.2)
13. Normal Healthy	1241	159 (12.8)
Sub Total	1437	179 (12.4)
Total	**3028**	**255 (8.4)**

Serum Urea etc. - Serum Urea, Uric Acid & Creatinine,

Table 3: Year-wise profile of clinical samples and prevalence of MAP infection in human population

Samples profile	Dec.2010 to June 2011*		Aug.2011-April 2012**	
	Samples (*n*)	Positives (%)	Samples (*n*)	Positives (%)
Non infectious health ailments				
Lipid profile	211	99 (46.9)	— —-	— —-
Diabetes	3872	821 (21.2)	4496	1480 (33.0)
Liver disorder	150	42 (28.0)	1165	533 (47.5)
Serum urea etc.	190	51 (26.8)	— —-	— —-
Thyroid disorder	1051	249 (23.7)	1598	518 (32.4)
Ion imbalance	63	32 (50.7)	569	358 (63.0)
Anemia	— —-	— —-	2025	765 (37.8)
LH,PRL	41	18 (43.7)	— —-	— —-
Sub total				
Infectious health ailments				
Typhoid	713	299 (41.9)	1433	626 (43.7)
Tuberculosis	104	35 (33.6)	139	57 (41.0)
Others	39	15 (38.4)	50	36(72.0)
Inflam. Illness	— —-	— —-	122	50(40.9)
Sub total				
Total	6434	1661 (25.8)	11597	4423 (38.1)

Serum Urea etc. - Serum Urea, Uric Acid & Creatinine, Inflam illness - Inflammatory illness

*Others-VDRL,TORCH etc.

*23rd dec.2010-14th June 2011, **25th Aug.2011-10 April 2012

Table 4: Comparative prevalence of MAP infection by two tests (serum ELISA and IS*900* blood PCR) from individual cases

Disease	Total samples (*n*)	ELISA		Blood PCR	
		Samples processed (n)	Positives (%)	Samples processed (n)	Positives (%)
Diabetes	441	31	7 (22.5)	31	2 (6.4)
Anemia	401	52	10 (19.2)	52	3 (5.7)
Liver disorder	181	44	16 (36.3)	44	3 (6.8)
Typhoid	157	61	13 (21.3)	61	4 (6.5)
Thyroid	91	37	12 (32.4)	37	2 (5.4)
Others	102	41	14 (34.1)	41	3 (7.3)
Total	1373	266	72 (27.0)	266	17 (6.3)

Others-VDRL,TORCH etc.

Achieving improved livelihood security through resource conservation and diversified farming system approach in Mewat (NAIP Component III)

D.K. Sharma and P.K. Rout

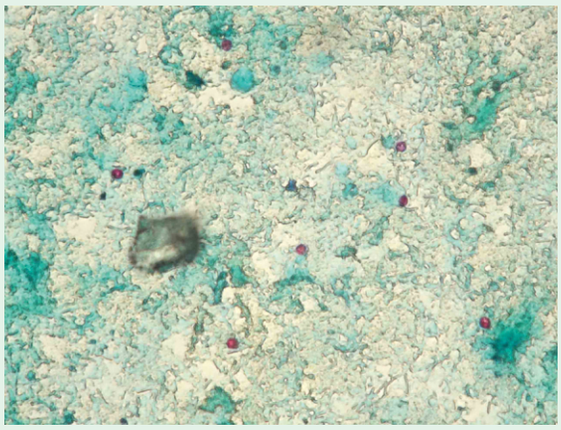
Under the project technologies like up gradation of local goats by elite bucks, feed supplementation, vaccination and deworming were introduced in 5 villages of Mewat district. In organized animal camps goats were vaccinated for FMD (60) and HS (60). Also deworming of 124 goats was completed. A group of 11 progressive goat farmers from 4 Mewat villages was imparted training on Scientific Goat Farming. Data on production and reproduction traits was recorded. Distributed goats showed population growth of 93.4, 134.8 and 96.96 per cent in Jharpadi, Singalhedi and Maroda villages respectively. The upgraded animals fetched better price than the local animals.

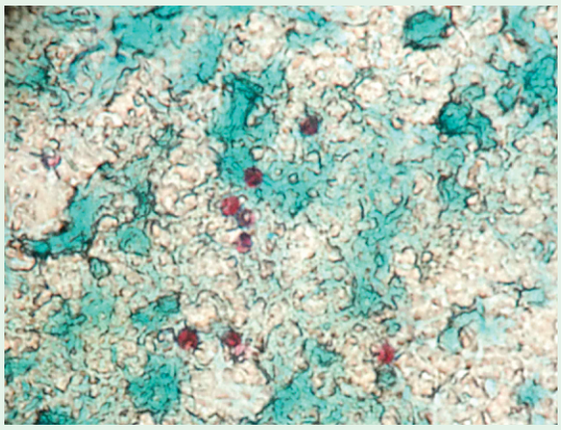
Pilot Study : Prevalence of Caprine Toxoplasmosis and Cryptosporidiosis

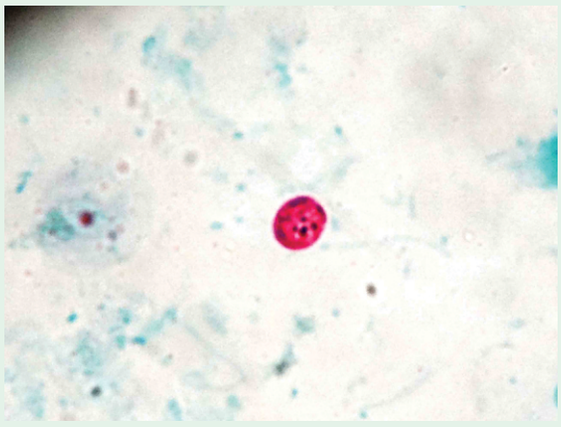
Souvik Paul, D.K. Sharma, Manjunatha Reddy G.B and Nitika Sharma

In the prevailing socio-economic conditions, goat rearing becomes an inseparable component of mixed farming system. A serious constraint to economical and intensive goat production is the mortality of kids as a result of diarrhoea (15-40%) up to the age of 3 months. Among the various diarrhoeal pathogens of goats viz. viruses, bacteria and parasites, cryptosporidiosis is one of the major health problems among the neonatal kids which causes neonatal diarrhoea. Apart from mortality (up to 40%), cryptosporidiosis causes decline in productivity, retarded growth, decreased feed efficiency, delayed maturity, loss of fertility and overall financial loss in the form of treatment of ailing animals.The present study was formulated for the search for *Cryptosporidium* spp. in goats, as there is no scientific data available on the occurrence of the disease in India.

A total of 350 diarrhoeic faecal samples from Jamunapari, Barbari and Jakhrana kids were tested by modified Ziehl-Neelsen technique. Among 350 samples, 142 were found positive for *cryptosporidium* oocysts in stained faecal smear. The results were analysed by one way ANOVA in SPSS (version 14), the prevalence rate was 41.14%. The prevalence was highest in







Jamunapari kids (44.18%) followed by Barbari kids (43.36%) and Jakhrana kids (38%). With respect to the age of the kids the highest prevalence was found in 0-15 days old kids (53.47 %) followed by 15-30 days old kids (31.08 %). Thus the occurrence of the disease was established, but further histopathological, epidemiological and molecular genetic studies are required for the characterization of the species of *Cryptosporidium* involved, so as to formulate a suitable control strategy against the disease.Another constraint to sustainable goat production is abortion of pregnant does.

Toxoplasmosis is one of the main causes of infectious reproductive failure in small ruminants. It causes fetal resorption, abortion, stillbirth and neonatal mortalities resulting in great economic losses. For serological detection of toxoplamosis in goats rSAG1 based ELISA was standardized and serum sample from 47 aborting does were collected and screened for toxoplasmosis by ELISA using whole cell lysate antigen, the results indicated 25 % incidence. Although, further sampling and characterization of the parasite is needed for future research in the direction of prevention and control of the disease. Considering the goat as a food animal is increasing, the monitoring and surveillance of cryptosporidiosis and toxoplasmosis should be taken up cautiously owing to their tremendous zoonotic importance.

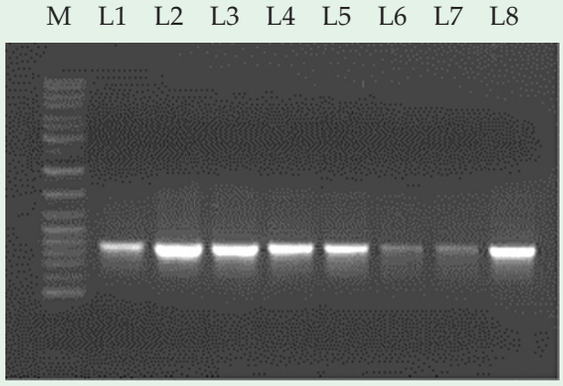
Table- Age wise prevalence of cryptosporidiosis in diarrhoeic kids

Samples (Positive by mZN stain)	Jamunapari		Barbari		Jakhrana	
Age Group (in Days)	0-15	15-30	0-15	15-30	0-15	15-30
Positive /Screened	38/79	20/58	37/65	13/54	20/49	14/45

Pilot Study : Etio-Pathology of Diarrhoea in Kids

G.B. Manjunatha Reddy, V.K. Gupta, Souvik Paul and D.K. Sharma

A total of 175 faecal samples from new born/young animals less than 3 months old showing history of diarrhoea and 24 intestinal samples in 10% formalin after post-mortem examination were collected from different livestock units of CIRG. The faecal samples were first examined for parasitic conditions in which 43 cases were found positive for *cryptosporidium* oocycts after staining with modified Ziehl Neelsen staining technique. All the samples were subjected for isolation of bacterial agents by inoculating in blood agar. A total 67 samples showed presence of single/diffused, convex, mucoid brownish colored bacterial colonies which on grams staining turned out to be gram negative cocci and coccobacillary in nature. These isolates on selective media (EMB) gave metallic shin appearance which confirmed the *E.coli*. The different biochemical tests catalase positive, oxidase negative, indole positive, methyl red positive, voges proskauer test negative respectively. Representative samples were subjected for antibiotic sensitivity test, which revealed sensitive to tobramycin, gentamycin, kanamycin, amikacin and resistant to vancomycin, ciprofloxacin, erythromcycin, sparfloxcin and oflaxcin. 13 samples showed mixed infection with *E.coli* and *Cryptosporidium*. The *E coli* isolates were further confirmed as pathogeneic strains by PCR after targeting the uspA gene (884bp size). Few samples were subjected for RNA isolation by Trizol method and RNA-PAGE was carried out for the presence of rotavirus. Two samples showed segmented genome on silver nitrate staining of the gel this we suspect as rotavirus further molecular confirmation was done by PCR targeting VP7 gene (304bp) of the rota virus. The formalin fixed samples were processed for histopathological examination which revealed sluffing of villus epithelium, shorting of villi, infiltration of polumorphs and lymphocytes, congestion and haemorrhages in the submucosa and mucosa with depletion of lymphoid cells in payer's patches. The microscopic lesions were suggestive of enteritis.



Agarose gel showing Usp specific gene amplification (884bp) of *Escherichia coli.* M: Marker, L1—L8 clinical samples.

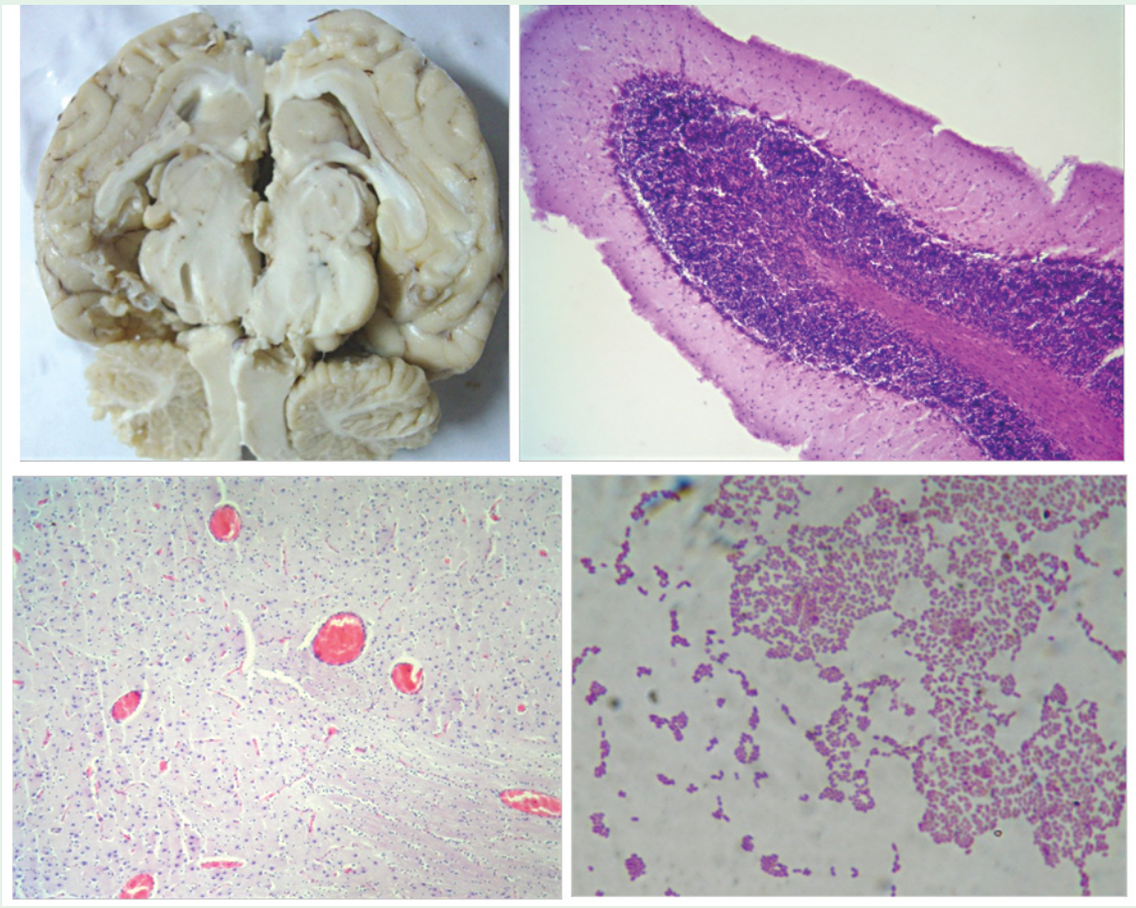
Pilot Study : Pathology of Neurological Diseases in Goats and Sheep

N. Shivasharanappa, V.K. Gupta, Ashok Kumar, G.B. Manjunath Reddy

A total of 65 goat and 40 sheep brain samples (total 105) were collected from post-mortem cases and goat product technology division during the period of May 2010 – March 2011. The objective of this project is to study the incidence and pathology of neurological diseases in goats and sheep. Gross examination of these brain samples revealed lepto-meningeal congestion in majority of the cases (41 goat brains (63.07%) and 21 sheep brains (52.5%), one case of *Ostrus ovis* in Sirohi goat (1.19%) was recorded and other brain samples did not show any gross lesions. A total of 45 (31 goat and 14 sheep) brains were processed for histopathology to record the microscopic lesions at different neuro-anatomical sites in the brain such as thalamus, hypothalamus, cerebrum, hippocampus, cerebellum, medulla oblongata, pons, cerebral peduncles and spinal cord.

45 brain and spinal cord were processed for histopathology and examined. The prominent changes noticed were vascular congestion and hemorrhage in the grey matter, degeneration of neurons in the cortex, neuronophagia and microgliosis at different anatomical sites. The less frequent lesions documented were lepto-meningitis, vascular oedema, vascular wall thickening, and multifocal hemorrhages in the cerebrum and cerebellum, focal to diffuse microgliosis, peri-vascular infiltration lymphocytes, macrophages and plasma cells and loss of neurons at many sites.

Isolation of listeria from above samples of brain and spinal cord was undertaken by US Department of Agriculture (USDA) method, as described by McClain and Lee (1988) i.e., UVM method of isolation. Among all brain samples processed for isolation, 11 goat and 2 sheep were found positive for listeria by their cultural and morphological characters. The characteristic black to grayish, small pointed, about 0.5 mm diameter surrounded by black zones were observed on PALCAM agar after streaking of UVM enriched culture. These were further confirmed by Gram's staining, biochemical and molecular characterization. These samples were further confirmed at microbiology lab, ICAR Research complex, Goa as *L. monocytogens*. For molecular characterization, virulence genes of *Listeria monocytogenes* such as plcA, prfA, hlyA, iap and actA were amplified by PCR and among these two isolates which found positive were submitted to VTCC, Hisar.



Figures 1 to 4 : *: Different anatomical sites in brain neuronal degeneration of cerebellum vascular congestion in the brain and Listeria monocytogenes Gram's positive cocco bacilli isolated from brain.*

Pilot Study : Development of alternative therapy for mastitis caused by Staphylococci using lytic bacteriophages

Anil Kumar Mishra, Ashok Kumar and Nitika Sharma

Prevalence of sub-clinical mastitis

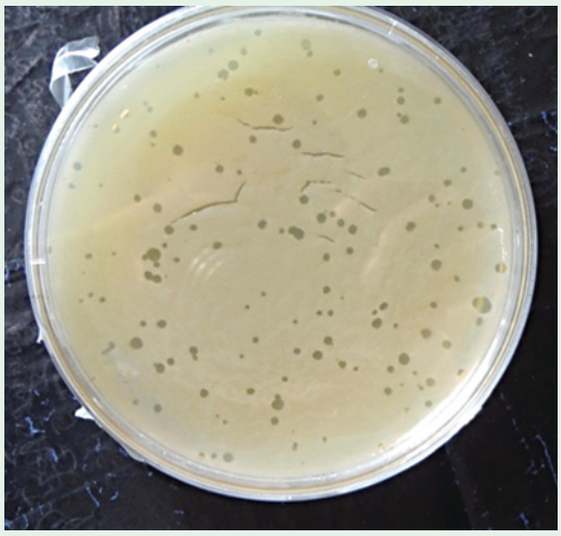
A total of 330 milk samples (110 samples from each breed, Jamunapari, Jakhrana and Barbari) from the goats of the institute flock were collected randomly to determine the prevalence of subclinical mastitis. The Status of the subclinical mastitis in the goats of the aforesaid breeds was determined by California Mastitis Test (CMT) and Somatic Cell Count (SCC). In the present study, when a milk sample showed the CMT score +1 or +2 and SCC e"10 lacs /ml, the particular udder was considered positive for subclinical mastitis. Overall prevalence rate of subclinical mastitis among the goats was determined as 24.2 %. The goats of Jakhrana breed demonstrated highest prevalence rate of subclinical mastitis (36.36%) then followed by Barbari (28.18 %) and Jamunapari goats (8.18 %).

Isolation and characterization of *Staphylococci*

From 330 samples, 95 isolates of *Staphylococcus* were isolated. Out of 95 isolates, 71 (31,31and 9 from Jakhrana, Barbari and Jamunapari goats respectively) were from subclinical mastitis cases. Out of 95 isolates, 23 isolates were found mannitol fermenter as well as coagulase positive, whereas 72 isolates were determined as coagulase negative. Likewise, 14 isolates of *Staphylococcus* isolated from clinical mastitis cases of the CIRG goats were found indistinguishable from *Staphylococcus aureus* by biochemical and molecular methods. The present study indicates that *Staphylococci* are the main etiological agents of clinical as well as subclinical goat mastitis.

Isolation and characterization of *Staphylococcus* bacteriophages

During the study, a total of 42 samples (soil/goat feces) were collected from the different sheds of CIRG and then processed for isolation of bacteriophages against *Staphylococcus aureus* associated with the clinical goat mastitis. Out of 42 samples, the phage presence was detected in 6 samples only. The isolates of *Staphylococcus aureus* bacteriophages were purified, propagated and the stocks of all the isolates were prepared, and are being maintained for further study. The stability of all the six isolates was determined at the temperature ranging from 30°C to 60°C, at pH ranging from 6.5 to 8.5 and chloroform treatment. Up to 40 °C, the lytic efficacy of the phages was found optimum, whereas above 50 °C the efficacy reduced to a greater extent. Between pH 6.5 and 7.5, the survivability of the phages was found 100%, while above pH 7.5 or below pH 6.5; the survivability was found considerably low. The chloroform treatment did not reduce lytic efficacy of the phages to a greater extent. All the six isolates showed a very wide lytic range (from 69 % to 87 %) against various *Staphylococcus* isolates from clinical as well as subclinical mastitis cases of the goats. The Isolate Number 1 (*Staphylococcus aureus* phage/CIRG/1) and Isolate Number 4 (*Staphylococcus aureus* phage/CIRG/4) showed lytic activity against 86 % and 87 % of the *staphylococcal* isolates respectively. The findings of the study indicate that both the phages (CIRG/1 and CIRG/4) could be used as therapeutic agents against goat mastitis caused by *Staphylococci*.



Plaques produced by the phage against indicator Staphylococcus aureus

Pilot Study : Isolation and identification of a PPR virus from an outbreak occurred in farmer's flock

Naveen Kumar, Kundan Choubay, R.V.S. Pawaiya and S.V. Singh

An outbreak of Peste des Petits Ruminants (PPR) occurred in sheep and goat at Nanakpur, Mathura, U.P. A team of scientist of CIRG visited the village. Symptoms observed were vesicular lesions on tongue and gums, diarrhea, hyper salivation, nasal and ocular discharge, fever, pneumonia and mortality was about 40%. The specimens of swabs (tongue lesions, nasal and ocular discharge as well as feces), tissues (lungs, intestine) and blood were collected on ice and immediately processed on arrival in laboratory. The swab samples which were collected in sterile glass tubes were vortexed briefly after adding 2 ml of DMEM. The stick/swab was removed and the tubes were centrifuged at 5000 RPM for 15 minutes to settle down the debris. The resulting supernatant was filtered using 0.45 micron syringe filter and stored in deep freezer. Tissue specimens were triturated with sterile sand in a pestle-mortar with 3 ml of DMEM and centrifuge at 5000 RPM for 15 minutes to settle down the debris. Similarly, the resulting supernatant was filtered using 0.45 micron syringe filter and store in deep freezer.

The different specimens were first screened by hemagglutination assay (HA). None other then intestinal specimens were positive in HA. However, later on, one of the specimens from tongue lesion showed positive signal in HA when sequentially passaged in vero cells three times (3rd blind passage). This specimen also exhibited the cytopathic effect (CPE) in vero cells (at 3rd blind passage), characteristics of Morbilliviruses (fusion, syncytia and cell death). This isolate was plaque purified, amplified and stored. The identity of this virus (PPRV-Nanakpur-2012) was further confirmed by Reverse Transcription PCR (RT-PCR). On serum neutralization assay, this PPRV strain poorly neutralized the hyperimmune sera as well as sera from vaccinated goats (vaccine supplied by Indian Immunologicals) which suggested that this might be a new PPRV strain, other then the known circulating PPRV strains in India. Further study on sequencing of its whole genome is being taken up.

EXTENSION EDUCATION AND SOCIO - ECONOMICS SECTION

EE&SE 1.03: Impact of Improved Technologies and Emerging Market Conditions on Goat Production System

Vijay Kumar (upto 25.01.2011), M.K. Singh, A.K. Dixit (w.e.f. 21.04.2011), Braj Mohan, Khushyal Singh and Anil Kumar (IASRI)

Goat keeping across the boundaries of income group, caste and religion, is on rise due to lesser initial investment, high economic return, better adaptability and easy management.

During the reported period information was collected on goat market, marketing set up and channels, purpose of buying and selling, determinants of sale price of goat, level of technology adoption and commercialization, impact on production/profit and constraints in technologies adoption. To collect above information, data were collected on pre tested and standardized schedule from goat keepers (85), buyers (50) sellers (50) and 12 commercial farms of Hamirpur, Mahoba, Jhansi, Lalitpur, Agra, Firozabad, Mathura, Hathras, Etah, Etawah and Kanpur districts (Uttar Pradesh), Raisen and Indore (Madhya Pradesh), Alwar, Jaipur, Sri-Ganganagar (Rajasthan), Ahmedabad (Gujarat), Coimbatore (Tamilnadu), Mysore (Karnataka), Nellore (Andhra Prades) and two North-Eastern states (Sikkim, Meghalaya).

Socio-Economic Status of Buyers and Sellers

Economic and social factors play an important role in determining the participation of individual in goat trade. Most of the sellers and buyers were socio-economically poor. Community wise distribution of buyers and sellers indicated that about 59% of sellers belong to backward class and 19% from scheduled castes. However, 80% of buyers belong to the backward class predominated by Muslims. About 63% and 65% of sellers and buyers were illiterate, respectively.

Existing Marketing Channels

Efficiency of goat markets exists in their channels through which goat products reaches to ultimate consumer from producer. About 8 channels were identified in different markets. However, the important channels through which animal sold and purchased are :

(i) Goat Farmer – Goat Farmer

(ii) Farmer – Itinerant trader – Local trader

(iii) Farmer – Itinerant trader – Butcher

(iv) Farmer – Itinerant trader - Local trader – Distant trader

More than 58% of female goats (for milk and breeding purpose) were transacted through channel (i). Furthermore, this channel has turned out to be the most efficient one. This may be due to the absence of intermediaries between producer and consumer. About 90% goats were sold through Channel (ii) at household level. It was observed that there existed contract between goat keepers and itinerant trader /butcher for advance payment as well as booking of the goats. As the goat keepers are poor and always in need of money to meet out their indispensable needs, they have to resort to distress sale of their goats. Above 75% of the goats headed to distant markets (other states) were predominated by male and aged females

were transacted through Channel (iv). Analysis also indicated that as the size of the market increases, transaction of goats through channel (iv) also increased. Average margin at itinerant traders/butchers level was about 15-20% and margins at distant trader level was 10-12%. Local markets were predominated by butchers followed by farmers. About 65% male goats for slaughter were transacted through channel (iii). Commercial goat keepers also purchased male and female goats for breeding purpose through this channel.

Purpose of buying and selling of goats

Various reasons were found for sale and purchase of goats in different markets/ villages. The itinerant trader in particular was more profit oriented however, marginal and landless goat keepers sell their animals for meeting their basic requirements. About75% of sellers reported profit motive and family consumption as one motive for sale of goats. Other reasons for sale of their goats were input purchase for crop production, marriage and other ceremonies, repayment of loans etc. About 65% buyers reported their motive of buying was profit through re-sale. About 30% buyers purchased goats for slaughter and 32% purchased for its rearing.

Determinants of sale price of goats

Sale price of goats is determined by the purpose of purchase. Sale price of breeding females was determined by its milk yield, body weight, breed, age and health. Usually, Rs. 2000-2500 is quoted for an animal yielding one liter of milk. An additional amount of Rs. 2000 was added for each liter of milk above that. Goats for breeding purpose were sold on 25-40% higher price. Whereas, determinants of sale price for goat (male) were live weight, age and health. In general, the age and live weight had a positive impact on the price of goats. Data collected from Jaswantnagar (Etawah) and Pachokhra (Firozabad) goat markets indicated the average bodyweight of goats brought to the market was about 21 kg within average age of 26 months. Average sale price irrespective of age, sex and weight was Rs. 2438. Breed-wise distribution of total animal sold & purchased revealed that 55% goats were non-descript followed by Barbari and graded Barbari (27%), Jamunapari (6%) and Sirohi and graded Sirohi (12%). Kalpi (Kanpur Dehat) is one of the largest goat market with 2-3 lakhs goats being transacted and most of them purchased by wholesale (distant) traders and further sold to traders in Kolkata, Assam, Mumbai, Hyderabad and Delhi for meat purpose. It was observed that pure bred goats constituted hardly 10% of total goat transacted.

Constraints in goat marketing

Poor economic condition and illiteracy of goat keepers compelled them for distress sale to butchers. Lack of market information, poor integration of small scale producers, distantly located markets, poor infrastructure, lack of grading and regulation of goat market are some of the important constraints in goat marketing. However, awareness programmes on goat sale has made great impact in minimizing the margin of middleman

Adoption of major goat technologies

Adoption level of major technologies/improved management practices were evaluated in 19 villages adopted by CIRG, NAIP-3 ,NGOs , villages previously adopted by CIRG (Makhdoom, Popa Burj, Bar Ka Nagla, Salempur, Pauri Sahjadpur, Gadaya, Sanaura, Pingari and Daulatpur) and goat farms established during last 5 years. The technologies transferred and being assessed were selective breeding, grading-up, breeding practices, strategic feeding (concentrate supplementation), vaccination against PPR and ET, deworming, housing and sanitation, value addition of goat products and marketing of goat at desired age/season. Result indicated highly varied level of adoption of technologies among the goat keepers in villages adopted by CIRG. Implementation of goat development programme (TOT/NAIP) motivated villagers, particularly small and marginal land holders irrespective of cast and community for goat rearing. Goat population size in adopted

villages were found to be increased by 20-35% during TOT programme. Major reason of increase of growth among population was health protection measures provided followed by breed improvement programme.

The adoption level of technologies was low to moderate (12-26% goat keepers/village) as the goat keepers are poorly resourced, illiterate with traditional mindset (do not invest on health protection, buck and proper housing). However, about 12-25% goat keepers in the villages have adopted the transferred technologies. Major improved management practices adopted were breeding practices, strategic concentrate supplementation, deworming (annual), marketing of goat and vaccination for PPR and ET in some flocks. Non-availability of veterinary aids and medicine were reported major constraints by goat keepers during non-adoption period. The amount of net return per goat ranged between Rs. 500-4500 with an average of Rs. 1875. The net return/goat was 50-75% higher in regular flocks where deworming, vaccination and concentrate supplementation at least for 180 days/year were practiced. However, 11% flock owners reported loss in goat farming on account of high mortality. Commercial scale goat farms reported great difficulties in obtaining pure-bred goats, and followed by non-availability of vaccines, improper and inadequate housing and non-availability of green fodder were also observed as limiting factor at such farms. Besides high potential breeding bucks of Barbari, Jamunapari and Jakhrana breeds, vaccines for PPR & JD and Health Calendar developed by CIRG were also adopted at many commercial goat farms. The commercial farms established in different region supplied the goats to the farmers, development agencies and NGOs. However it is strongly desirable that such commercial farms should be monitored by appropriate agency to check indiscriminate breeding, dilution/ extinction of native breed. Some new varieties of goat have been developed by traditional goat keepers such as Batisi, Totapari, Sojat primarily for milk production. Prices of such goat genetic group/ strains are similar or higher than Jamunapari goat and ranged from Rs. 6000-15000.

Under current goat development programs in Mathura, Hamirpur and Mahoba (Bundelkhand), majority of goat keepers adopted technologies till development agencies/institute provide input at free of cost or at very low price. Major reasons of poor adoption level of technologies are:

- Poverty, lack of education and appropriate exposure.
- Inaccessibility of critical inputs (vaccines, medicines, bucks/goats and advisory services).
- Goat is reared as subsidiary source of income thus low attention is paid.
- Poor motivation due to lack of follow-up programmmes.
- Lack of interest among youths of goat keepers to continue goat farming.
- Scarcity of feed and fodder resources.
- Shift to other means of livelihood due to social stigma.

Suggestions for Higher Adoption of Technologies

- Transfer of Technology should be conducted through establishing farmers groups and some fund should be generated to sustain such programs for future.
- Setting of follow-up programmes and development of skill among few identified lead persons per village is also necessary to sustain goat development.
- Vaccination for PPR and grading up of non-descript goats by superior bucks were found as the most essential goat developmental measures and should be implemented sincerely by State Animal Husbandry Department.
- Low cost feeding resources have become critical for goat rearing by landless farmers, which comprises the major share

of goat rearers.

- An integrated package of management practices for different livestock species should be transferred as most of goat keepers also rear other livestock species.
- Monitoring by government agencies is necessary to check indiscriminate breeding particularly from exotic origin.

EE&SE 1.04: A study on impact of various training programmes on commercial goat farming

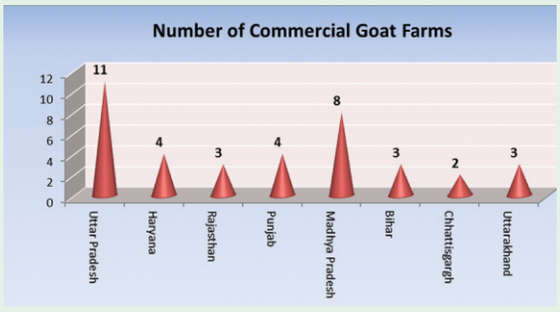
Khushyal Singh, Braj Mohan A.K. Dixit and Vijay Kumar

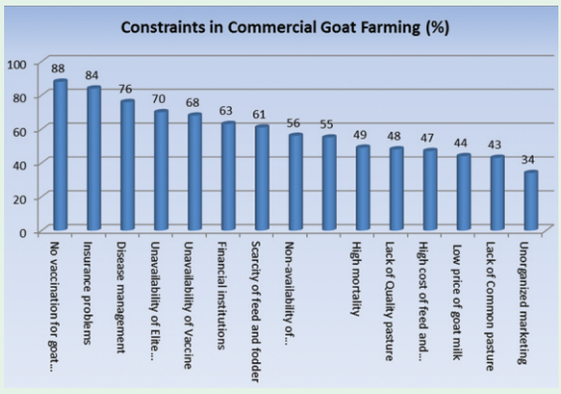
Data were collected from 125 trainees of 8 states namely, Bihar, Madhya Pradesh, Uttar Pradesh, Haryana, Rajasthan, Punjab, and Chhatisgarh to obtain feedback on performance of commercial goat farms, constraints in starting new goat farms, knowledge, marketing channel and marketing problems. Out of 125, 38 trainees (Haryana-4, Uttar Pradesh-11, Punjab-4, Bihar-3, Madhya Pradesh-8, Rajasthan-3 and Chhatisgarh-2) started commercial goat farming with non-descript, Barbari, Sirohi and Jamunapari breeds. (Figure 1)

As per the feedback, the survivability of adult goats in the commercial goat farms was good. Marketing of the animals were based on rough estimate rather than body weight basis. Middlemen and butchers mainly managed marketing of goats. Some of the commercial goat farmers started strategic marketing plans for Eid, Holi, Diwali and other local festivals. They reared castrated males which fetched better price to the farmers. Kid mortality was particularly higher in all commercial goat farms. There were many constraints responsible for high mortality viz. low adoption of improved practices and preventive goat health calender, non-availability of critical inputs like vaccines, size of flock, type of housing, etc. Some problems of the commercial goat farmers were reported as prevalent dystocia, abortion & stunted growth of kids.

Gap in knowledge and adoption of improved technologies were on higher side due to inaccessiblity of critical inputs. The level of adoption of these technologies was also not good. Higher technology adoption on commercial goat farms led to low mortality losses as compared to traditional flocks. However there was a wide gap in the level of adoption and large proportion of the commercial farmers had not adopted the recommended technologies.

The constraints in commercial goat farming are depicted in figure 2. The major problems faced in the initial stage of goat farming were high incidence of diseases, non-availability of vaccines, medicine, veterinary care, lack of elite germplasm and common pastures. Majority of these farmers struggled to sale their goats on live body weight basis and the price obtained ranged from Rs. 120 to Rs. 150 per kg of live body weight. The price was higher for castrated male during festive seasons. The farmers producing quality breeding animals got attractive prices from the goat breeders. On an average in a





commercial farm the total number of goats were nearly 250. The majority of the farmers wanted to increase their flock size up to 300 – 800 goats. For that desired support in the form of technical knowledge and easy institutional finance & insurance is essentially needed.

EE&SE 8.15: Sustainable Livelihood Through Goat Farming By Disseminating The Improved Goat Production Technologies

Braj Mohan, A.K. Goel, A.K. Dixit(w.e.f. 21.4.2011), Ashok Kumar, Khushyal Singh, U.B. Chaudhary, R.B. Sharma, M.K. Singh, H.A. Tiwari, Vijay Kumar, N. Ramachandran, Ravindra Kumar, Anil Kumar (IASRI) (Oct., 2010)

Reproduction Component (A. K. Goel)

Project is aimed to enhance income and socio – economic status of farmers by adopting scientific goat farming practices. Under reproduction component study was undertaken to collect information on various reproductive parameters to assess the extent and nature of reproductive problems in farmers flocks, organization of village camps for different reproductive ailments and reproductive health care of affected animals. In order to achieve the targets under reproduction component, visits were undertaken in adopted village - Hyatpur. Breeding Barbari bucks (02) were supplied to goat farmers for breed improvement in their non – descript /Barbari flocks. Emphasis was given for breeding of oestrus goats in major breeding seasons rather than round the year breeding practices. For this a reproduction health calendar was distributed to goat owners. Reproductive health care of affected goats was undertaken. In total twenty seven cases of specific reproductive ailments were diagnosed and appropriately treated in adopted village. During this period a total of 52 goats were screend for their pregnancy status. In Health Camp, 15 goats were examined for pregnancy/ non-pregnancy and four goats were treated for anoestrus condition; besides drenching of 56 goats with dewomer.

Socio-Economic Status of Goat Keepers

Data were collected from 35 goat farmers in CIRG adopted village Hayatpur to study socio-economic status of goat farmers. Analysis of data indicated that majority of the goat farmers were landless (49%) followed by marginal (34%), small (9%), medium (6%) and large (3%). Of the 35, 54% were belonged to SC&ST category followed by other Backward Class (20%), General (17%) and Minority (9%). Education status of goat keepers indicated that 60% of the goat farmers were illiterate and only 28% were high school and above. Further, more than 50% goat keepers were agricultural labourer with an annual income of Rs. 10,000 to 20,000. Distribution of goats according to landholding size (Fig.1) revealed that 48% goats were reared by marginal farmers followed by landless (40%) and small (9%). Breed wise distribution of goats indicated that 49% goats were of Barbari breed followed by Sirohi (27%) and Non- Descript (24%).

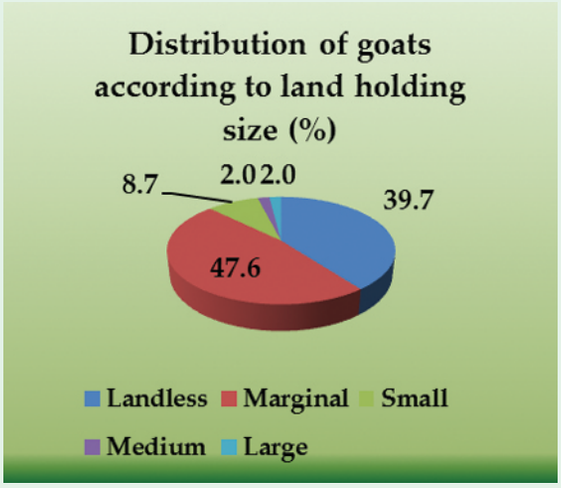


Figure 1: Distribution of goats according to land Holding Size

Goat Housing and Veterinary Care

Information collected from sample households of goat farmers (35), indicated that about 66% of goat houses were Kaccha type, 30% were mixed and 4% were Pucca house. About 66% goat

farmers availed services of private veterinarian followed by home remedy (17%). Only 12% goat farmers visit govt. veterinary hospital and rest (6%) availed all type of services.

Breed Improvement Programme

Under breed improvement programme 3 Barbari bucks were provided to goat farmers. The performance indicators show that 111 goats were bred. Information analyzed only for 51 goats of Hayatpur village who delivered 84 kids. Remaining goats of the same village and neighbor villages were sold. Sex wise distribution of new born kids indicated that out of total kids born; 43% were male and 57% female, respectively. 65% of goats delivered twins. 96% kids born were either Barbari or Barbari type. Average body weight of male and female kids at the age of 3 months was 8.9 Kg (n=11) and 7.8 Kg (n=12), respectively. Goat farmers were motivated to adopt improved breeding and management practices.

Healthcare

Goat were provided timely strategic deworming and vaccination against infectious diseases, along with treatment of cases presented during visit and clinical camps. During clinical camps, animal owners were advised and trained for packages of practices in prevention of goat diseases. The major clinical conditions were observed pneumonia, upper respiratory infection (coughing), diarrhea, dermatitis, mange, tympany, septic wound, anorexia and fever. The total 38 cases were provided treatment. The endo parasitic infestation mainly caused by *Haemonchus contortus* and *Fasciola* sp. was managed by strategic Albendazole and combination of Levamisole & Oxyclozanide combination to control infection. The scheduled vaccination against PPR, ET and FMD were also conducted. FMD, HS combined vaccination was done in 349 animals. No outbreak was observed during the reported period.

Extension Education Activities

Visits and advisory services : In all 35 visits were made by the scientists and technical staff in the adopted village and individually contacted 419 goat farmers including women goat keepers. They were educated and motivated about the scientific/ commercial goat rearing and were convinced to take the services from the elite Barbari Breeding bucks because this area is home tract of Barbari breed. Barbari buck keepers were also provided pelleted feed.

Self – Help Groups : Support was extended to Self –Help Groups (SHGs) of Hayatpur village for enhancing their livelihood through scientific goat farming. Financial literacy campaign was organized in collaboration with NABARD, Mathura.

Group Discussions : Three group discussions were conducted on housing management and care of pregnant goats, besides nutritional intervention and mineral supplementation and healthcare. In the adopted village display boards were fixed depicting TOT activities.

On Field demonstration, organization of health camps and other services

- Demonstration of vermicompost was conducted for proper use of manure.
- Blood samples were collected for diagnosis of brucellosis and 4 animal health camps were organized in the village.
- Pregnancy diagnosis in females and growth of kids born to CIRG buck was done periodically and off-campus trainings(3) were organized on scientific goat rearing.

AICRP

AICRP on Goat Improvement

D. Swarup and S.K. Singh

Table : Ongoing AICRP units during XI Five Year Plan

Sl. No.	Name of the Unit	Location	Type of Centre
From X Plan:			
1.	Jamunapari Farm Unit	CIRG, Makhdoom	ICAR based
2.	Barbari Farm Unit	CIRG, Makhdoom	ICAR based
3.	Sirohi Farm Unit	CSWRI, Avikanagar	ICAR based
4.	Jamunapari Field Unit	CIRG, Makhdoom	ICAR based
5.	Marwari Field Unit	RAU, Bikaner	SAU based
6.	Black Bengal Field Unit	WBUVS & F, Kolkata	SAU based
7.	Ganjam Field Unit	OUA & T, Bhubaneshwar	SAU based
8.	Sangamneri Field Unit	MPKV, Rahuri	SAU based
9.	Surti Field Unit	GAU, Navsari	SAU based
10.	Malabari Field Unit	KAU, Trichur	SAU based
11.	Sirohi Field Unit	MPUA & T, Udaipur	SAU based
New Units during XI Plan:			
12.	Black Bengal Field Unit	BAU, Ranchi	SAU based
13.	Assam Hill Field Unit	AAU, Guwahati	SAU based
14.	Gaddi Field Unit	HPKV, Palampur (HP)	SAU based
15.	Osmanabadi Unit	NARI, Phaltan (MH)	NGO

EDUCATION AND TRAINING

Training Programmes Organized

- Organized and conducted five days training programme on scientific goat rearing on 11-15 April, 2011 to 20 progressive farmers sponsored by ATMA, Darbhanga, Bihar.
- Organized and conducted five days training programme on scientific goat rearing on 3-7 May, 2011 to 16 progressive farmers sponsored by ATMA, Vaishali, Bihar.
- Organized and conducted three days training programme on scientific goat rearing on 11-13 May, 2011 to 22 progressive farmers sponsored by Uttar Bastar, Kanker, Chhatisgarh.
- Organized and conducted a 10 days 47th National Training Programme of 10 days duration on Commercial Goat Farming on May 18-27, 2011. It was attended by 78 participants from 14 States (U.P.-31, Haryana-11, Bihar-10, M.P.-6, Uttarakhand-5, Karnataka-3, Rajasthan-2, Delhi-2, Maharashtra-2, Andhra Pradesh-2, Gujarat-1, Jharkhand-1, Punjab-1 and West Bengal-1).
- Organized and conducted five days training programme on scientific goat rearing on 6-10 June, 2011 to 20 progressive farmers sponsored by ATMA, Madhepura, Bihar.

- Organized and conducted a training programme on scientific goat rearing to veterinary officers sponsored by Department of Animal Husbandry, Punjab, Chandigarh on 1-6 August, 2011. It was attended by four veterinary officers were present.
- Organized and conducted one day training programme on scientific goat rearing on 24.8.2011 to five veterinary officers sponsored by Chief District Veterinary Officer, Dhenkanal, Odisha under capacity building for poverty reduction (CBPR) programme.

- Organized and conducted 48th National Training Programme of 10 days duration on Commercial Goat Farming on 26-September- 5 October, 2011. It was attended by 61 participants from 11 states namely (U.P.-24, MP-3, Bihar-11, Delhi-3, Rajasthan-8, Haryana-2, West Bengal-4, A.P.-2, Punjab-1, Karnataka-2 and Uttarakhand-2).
- Organized and conducted a 5 days training programme on scientific goat rearing on 1-5 Novemer, 2011 to 11 goat farmers sponsored by NAIP Mewat, Haryana.
- Organized and conducted 49th National Training Programme of 10 days duration on Commercial Goat Farming on 1-10

December, 2011. It was attended by 62 participants from 13 states namely (U.P.-18, Maharashtra-8, Haryana-7, Delhi-6, A.P.-5, Rajasthan-4, Jharkhand-3, Punjab-3, Bihar-2, M.P.-2, Karnataka-2, West Bengal-1 and Gujarat-1).

- Organized and conducted a 5 days training programme on scientific goat rearing from 9 to 13 January, 2012 to 15 farm women and 5 farmers sponsored by ATMA, Darbhanga, Bihar.
- Organized and conducted a 10 days training programme on scientific goat rearing from 18 to 27 January, 2012 to 28 dalit women and 4 farmers sponsored by ATMA, Begusarai, Bihar.
- Organized and conducted a 3 days training programme on scientific goat rearing to 18 farmers sponsored by Gramin Vikas Kendra, Nalanda, Bihar on 1-3 February, 2012.
- Organized and conducted a 5 days training programme on scientific goat rearing from 2 to 6 March, 2012 to 12 goat farmers and one Pashudhan Adhikari sponsored by Joint Director, Animal Health, Directorate of Animal Husbandry district Aurangabad, Patna, Bihar.
- Organized and conducted 50th National Training programme of 10 days duration on Commercial Goat Farming on 19 – 28, March, 2012. It was attended by 63 participants from 12 states (U.P.-28, Haryana-10, Maharashtra-7, M.P.-7, Bihar-4, Delhi-1, Rajasthan-1, Jharkhand-1, Chhatisgarh-1, W.B.-1, A.P.-1 and Karnataka-1).

Training Participants

Name of the training	No. of trainings	Category of trainees
Commercial goat farming (National training Programme)	4	Goat entrepreneurs = 262 Women = 02 Total = 264
Scientific goat rearing (Sponsored training)	11	Goat farmers = 1202 Women = 473 Veterinary officers = 094 State officers = 05 Total = 1774
Total	15	Total 2038

Technical correspondence

In all 60 inquiry letters of which 44 in Hindi, 15 in English and 1 in Kannada were received from different categories of aspirants covering different of parts of country on various aspects of goat reproduction and replied suitably.

Visit arrangement

In all 1416 visitors were entertained and apprised with research, extension and development activities of the institute

Helpline Services for the benefit of Goat Farmers

The farmers help line initiated by the Institute has become immensely popular among the goat farmers, entrepreneurs and commercial goat farmers, and a large numbers of them are contacting the Institute for seeking information and knowledge on improved goat technologies.

In all 1801 calls were received regarding various aspects of commercial goat farming, improved goat production technologies, elite germplasm and training programmes and replied suitably

Collaboration with KVK Mathura

Institute participated in three health camps organized by KVK, Mathura in 3 adopted villages of U.P. Pt Deen Dayal Upadhyay Veterinary University, Mathura.

Collaboration with IARI, New Delhi

Conducted 10 frontline demonstrations of wheat varieties in the adopted villages of CIRG, Makhdoom.

Field Experience Training (FET)

Organized and conducted a field experience training (FET) for 8 scientists (94th FOCARS batch) from NAARM, Hyderabad on 8-28 November, 2011 (21 days).

Participation in Exhibition/Kisan Mela

The Institute team actively participated in the following Exhibition/Kisan Mela organized during the year :

Participated in Krishi evam Gramya Vikas Pradarshani at Pt. Deen Dayal Dham, Farah, Mathura on 24-26 September, 2011.

Krishi Mahakumbh (Kisan Mela) evam Pashu Pradarshani at Kosi Kalan, Mathura U.P. on 10-12, October, 2011.

Purvi Rajasthan Krishi Vigyan Mela evam Krishi Udyog Pradarshani, 2011 at Bharatpur Rajasthan on 3-5 November, 2011. Sponsored by Lupin Human Welfare and Research Foundation, Bharatpur(Rajasthan) (Won IIIrd Prize).

Kisan Mela at IVRI, Izatnagar, Bareilly (U.P.) on 18-20 October, 2011.

Exhibited CIRG stall at India International Trade Fair (IITF), on 14-27 Nov. 2011 at Pragati Maidan, New Delhi.

Bhed and Kisan Mela organized by CSWRI, Avikanagar on 4th January 2012 (Won IInd Prize).

18th Sarson Vigyan Mela at Directorate of Rapeseed- Mustard Research, Sewar, Bharatpur (Rajsthan) on 3.2.2012.

Exhibition with 'Animal Show' of Global Conference on Women in Agriculture in (GCWA) at NASC Complex, New Delhi on 13-15 March, 2012.

Kisan Mela at KVK, DUVASU, Mathura on 21.3.2012 .

Republic Day Celebration

Institute celebrated the 62nd Republic day with devotion, sincerity and joy. Dr. Devendra Swarup, Director of the Institute in his inaugural address encouraged the staff to work hard with sincerity and devotion to enhance livelihood status of goat keepers. He put stress on maintaining discipline and feeling of brotherhood among the staff.

Institute Foundation Day Celebration

Institute's foundation day was celebrated on 12th July, 2011. Dr. A.P. Singh, Vice Chancellor, DUVASU Mathura was the chief guest for function organized for the occasion. He reiterated that goat holds the future for the poorest of poor in this country and is essential for the progress and survival.

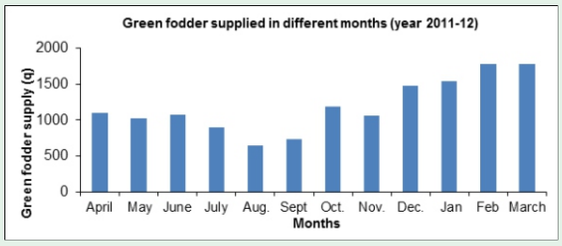
Agriculture Farm and Agroforestry Section

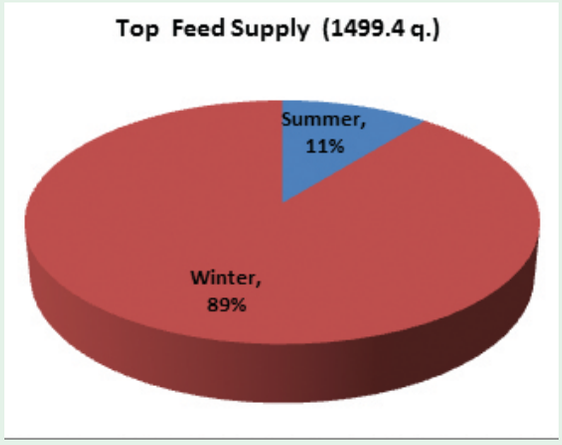
T.K. Dutta and Prabhat Tripathi

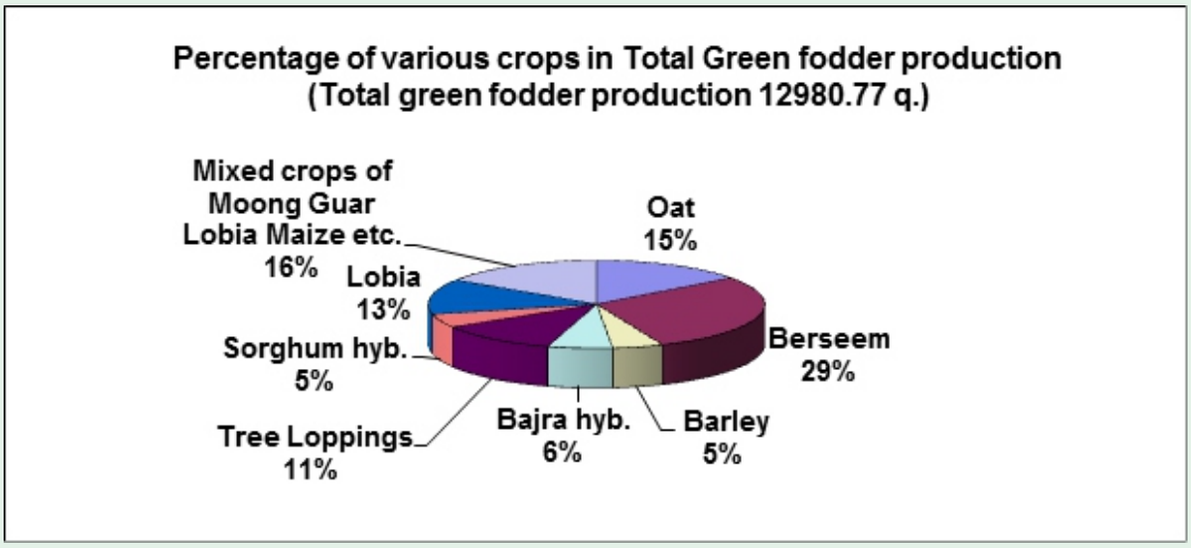
Agriculture farm section is working with main objectives to produce nutritionally sound fodder for goats and sheep in the institute and to develop ravenous degraded soils of the institute in to a fodder production models through agroforestry or other agricultural interventions. Section also supports horticulture, maintenance section and staff welfare club through regular irrigation of road side ornamental plants, supply of drinking water to entire institute.

During the year 2011-12 this section produced 12980.77 quintals green fodder, which included leguminous, non-leguminous cultivated fodder crops and tree lopping as top feed. Except rainy season (July, August and September) and period of leaf sheding (February and March) rest seven months top feed was supplied to all livestock units. Fodder crops were raised in a legume and non-legume rotation so that soil fertility remains in a static condition.

In addition to green fodder, farm section also produced about 485 quintals of Barley and Oat grains. This section also maintaining various new plantation areas with fodder trees under agroforestry system. During the reporting year, 4 acre new land area was brought under agroforestry system with plantation of Azadirachta *indica, Ficus glomerata, Ficus lacor* and *Zizyphus species* etc. An area of about 15 acre was cleaned for its utilisation under agroforestry and fodder cultivation in future. About two acre land area was developed and maintained under herbal agroforestry with 80 different plant species of medicinal importance. 200 numbers of ornamental perennial plants were also maintained at farm and agro forestry section of the institute.







Linkages and Collaborations

The institute has developed effective linkages with DUVASU, Mathura; IVRI, Izatnagar; NDRI, Karnal; IARI, New Delhi; CCS HAU, Hisar; Dr. B.R. Ambedkar University, Agra; CARI, Izatnagar; NIANP, Bangalore; IGNOU, New Delhi; CSWRI, Avikanagar; IGFRI, Jhansi and various Agricultural Universities and NGOs. under AICRP programme. Institute is also running a project in collaboration with Biovet Pvt., Bengaluru under Public Private Partnership programme.

Technology Services

Goat Germplasm supplied : CIRG Makhdoom supplied 689 superior animals of Barbari (366), Jamunapari (212), Jakhrana (27) and Muzzafarnagari (84) sheep breeds to the progressive farmers and various government agencies for breed improvement programmes.

Diagnostic Services provided

For the screening of map infection, samples (serum, fecal) from Veterinary College, Mathura, Faizabad and Pondicherry and Regional Centres of CSWRI, Avikanagar (SRC, Kodai Kanal and WRC, Bikaner) were received. These samples were screened by ELISA, microscopic examination, faecal culture and PCR.

Frozen Semen Technology Standardized and used Successfully for AI in Goats

Use of frozen semen technology for AI is an important tool for effective multiplication of superior germ plasm in farm animals. The technology has been perfected and used successfully in bovines. However, in small ruminants, especially goat, this procedure is difficult, due to the smaller body size and, a more complicated anatomy of the reproductive tract. Goat has a more complex cervix than other ruminant livestock. Therefore, attempts to implement frozen semen based AI technology for goats have been not very much encouraging. A team of scientists of CIRG under leadership of Dr. SK Jindal undertook the challenge to perfect the frozen semen technology for successful AI in goats. Drs. Priyadarshini Raju, SD Kharache, AK Goel and N Ramachandran were the other members of the team. The team performed AI in 30 Sirohi and 27 Barbari goats using frozen goat semen from elite bucks. Regular heat detection using apronized buck was done during the breeding season (May to July). Does in heat were inseminated within 24 hrs using a speculum and AI gun. Approximately 50 million sperms per dose were used. The conception rate was determined by B-mode real time ultrasonography on day 35 after last insemination followed by actual kidding. On the basis of actual kidding, the conception rate was 23.33 % in Sirohi and 25.92 % in Barbari goats. In total 19 kids were born from AI. The experiment is being repeated in more number of animals at different flocks of the institute. The encouraging success of the experiment, however underlines the great potential of artificial insemination for improving native goat genetic resources and farmers flocks through use of elite buck semen from organized farms in future.

AWARDS AND RECOGNITIONS

Institutional Awards

The Institute received **SARDAR PATEL ICAR OUT STANDING INSTITUTE AWARD -2010** has been given to this Institute.

- CIRG awarded First Prize and Chal Vaijayanti -2011 by Nagar Rajbhasha Karyanwayan (NARAKAS) Mathura under Department of Official Languages, Ministry of Home Affairs, Government of India.
- CIRG won the Second Prize in Bhed Evam Kisan Mela held at CSWRI, Avikanagar (Raj.) on January 4, 2012.
- Third Best Exhibition Award in the Eastern Rajasthan Kisan Vigyan Mela organized by LUPIN Human Welfare & Research Foundation in Bharatpur held on Nov 3-5, 2011. More than 75 organizations particiated in the exhibition.
- Indira Gandhi National Open University (IGNOU), New Delhi has recognised the Institute as a study center for Diploma in Meat Technology (DMT) course and appointed Dr. R.B. Sharma, Senior Scientist (LPT) as part time programme Incharge to coordinate it. Mr. Akshay Kumar of this study center was awarded with University Gold Medal-2011 by IGNOU for securing first position in DMT.

Individual Awards and Recognitions

A.K. Goel

- Chairman of a Scientific Session in National Seminar on Sheep and Goat Production at Sandynallah, The Nilgiris, Tamilnadu (India), 28 – 29 Dec., 2011.
- Rapporteur of a Scientific Session in National Seminar on Prospects and Retrospect of Small Ruminant and Rabbit Production, ISSGPU, Avikanagar at Jaipur 7-9 December, 2011.

Braj Mohan

- Mohan,B.,Dixit,A.K., & Singh,K. and Kumar,V. (2011). Angikrat Gaon me Bakri Palan ke Samajik –Arthik Star par Ek Adhyan. Presented in Hindi Shodh Patra Pratiyogita at CIRG, Makhdoom on 24.9. 2011(Won IIIrd Prize).
- Extension Education and Socio-Economics Section was awarded Prashast-Patra by the Director, CIRG, Makhdoom in connection with Rajbhasha Hindi mein Utkrashta Karya Karne Hetu .

G.B. Manjunatha Reddy

- Young Scientist Award 2011 at the 13th National conference of APCRI held at Chennai from 9th-10th July, 2011.
- Best Doctoral Thesis Award at Indian Association of Veterinary Pathologists (IAVP) annual conference held at Chennai, Dec 28-30, 2011.
- Dr.C.M.Singh Best Research Article published in Indian Journal of Veterinary Pathology at IAVP annual conference held at Chennai, Dec 28-30, 2011.

Gopal Dass

- Received First Prizein Shodh Patra Pratiyogita and Hindi Hastakshar Pratiyogita during Hindi Pakhwada at CIRG, Makhdoom from 14-28 September, 2011 .

Souvik Paul

- Awarded prize for Poster Presentation Caprine Cryptosporidiosis in Jamunapari and Barbari Goat kids from India. By-Souvik Paul, D.K. Sharma and G.B. Manjunath Reddy at International Conference on Emerging trends on Food and Health Security in Cold Deserts. Organised by DIHAR, DRDO at Leh-Ladakh during 23rd-25th, September, 2011

S.D. Kharche

- Rapporteur of a scientific session in National symposium on Reproductive Biotechnologies for augmenting fertility and conservation of animal species with special reference to North Eastern Hill region and XXVII Annual convention of ISSAR at CAU, Aizawl, 27-29th, September, 2011.
- Advisory committee memberof a National Fund Project on "Deciphering the mechanism of abberant maternal recognition of pregnancy (MAP) events in sheep and buffalo under heat and nutritional stress".

S.K. Jindal

- Elected as a member of the executive committee of the Indian Society of Sheep and Goat production and Utilization (ISSGPU).
- Nominated member of the "Editorial Board " of Animal Science Reporter Journal.

S.V. Singh

- Cash Award of Rs. 50, 000.00 from National Research Development Council, New Delhi to Dr. S.V.Singh, 2011 for the development of ELISA kit for diagnosis of JD in animals.
- 'Travel Grant Award for attending Annual meeting of International Conference of Johne's Disease Integrated Program (JDIP):with dairy and animal science Joint Annual Meeting (JAM), July 10 & 14, 2011, New Orleans, Louisiana, USA.
- Fellowship for attending the workshop on Mathematical modeling of JD: At NIMBioS at the University of Tennessee, Knoxville, USA: July 6-8, 2011.

Meteorological Observations (2011-12)

Months	Mean Max Temp. (°C)	Mean Min. Temp. (°C)	Mean Daily Temp. (°C)	Mean Vapor Pressure (mmHg)	Mean RH (%)	Mean Rain Fall (mm) / Wet Days	Sun Shine (hrs)
April 2011	38.62	19.75	29.18	12.1	30.76	8.0	288.3
May 2011	43.0	25.13	34.06	16.27	33.19	23.0	299.6
June 2011	39.3	25.95	32.59	22.38	56.54	78.2	223.7
July 2011	34.9	25.24	30.07	26.0	74.02	193.8	149.4
August 2011	34.74	25.56	30.15	26.25	76.25	131.0	185.7
September 2011	35.27	24.2	29.75	23.70	68.38	83.2	253.6
October 2011	36.15	18.16	27.15	15.0	44.54	0	283.3
November 2011	31.28	13.65	22.47	12.96	57.47	0	207.9
December 2011	24.68	7.03	15.85	9.91	64.70	0	203.0
January 2012	20.52	6.89	13.7	9.23	71.09	29.8	168.3
February 2012	25.17	8.47	16.82	8.80	50.47	0	234.8
March 2012	35.10	13.63	23.36	10.27	36.90	0	282.5

Maximum temperature: 48.5 °C on 08.06.2011

Minimum temperature: 0°C on 27.12.2011

Annual Rain Fall: 550.8 mm in 50 Days

PUBLICATIONS

Research Articles

1. Banerjee, Rituparna, Verma, Arun K., Das, Arun K., Rajkumar V., Shewalkar, A.A., Narkhede, H.P. (2012). Antioxidant effects of broccoli powder extract in goat meat nuggets, *Meat Science*, 91: 179-184.
2. Bhusan, S., Sharma, A. and Tiwari, H. A. (2011). Health problems of Jakharana goats in the winter season under semi-intensive farming system. *Indian Journal of Small Ruminants*, 17 : 130-131.
3. Chauhan, K.K., Rout, P.K., Dass, Gopal, Singh, S.K., Shukla, S.N. and Roy, R. (2011). Susceptibility to natural gastro-intestinal nematode infection during different physiological stages in goat and sheep in the semi arid tropics. *International Journal of Livestock Production*, 2: 166-171.
4. Cuthbert, R , Taggart, M.A., Prakash, V., Saini, M., Swarup, D., Mateo, R., Chakraborty, S.S., Deori, P and Green, R.G. (2011) Effectiveness of action in India to reduce exposure of Gyps vultures to the toxic veterinary drug diclofenac. *PLOS-One* e19069. doi:10.1371/journal.pone. 0019069.
5. Cuthbert, R.J., Prakash, V., Saini, M., Upreti, S., Swarup, D,, Sharma, A.K., Das, A., Green, R.E. and Taggart, M. (2011) Are conservation actions reducing the threat to India's vulture populations? *Current Science* 101: 1080-1084.
6. Das, A.K., Rajkumar, V., Verma, A.K., Swarup, D. (2012) *Moringa oleifera* leaves extract: a natural antioxidant for retarding lipid peroxidation in cooked goat meat patties *International Journal of Food Science and Technology* 47: 585–591.
7. Das, A.K., Rajkumar V and Singh S K. (2011). Effect of litter size on growth, carcass and meat quality characteristics of Barbari kids. *Indian Journal of Small Ruminants* 17 (1): 68-73.
8. Das, A., Katole, S., Kumar, A., Gupta, S.P., Saini, M. and Swarup, D. (2011). Feed consumption, nutrient utilization and serum metabolite profile of captive blackbucks (*Antelope cervicapra*) fed diets varying in crude protein content. *Journal of Physiology and Animal Nutrition* DOI:10.1111/j.1439-00396.2011.01162x.
9. Dhama, K., Mahendran, M., Tiwari, R., Singh, S.D., Kumar, D.,Singh, S.V., Sawant, P.M., (2011). Tuberculosis in birds: Insights into the *Mycobacterium avium* infections. *Veterinary Medicine International*, ID 712369), doi:10.4061/2011/712369.
10. Dixit, A. K., Reddy,B.S.,Singh, Manohar. (2012). Demographic changes in small ruminant population in India: Some inferences from different livestock regions. *Indian Journal of Animal Science* 82 :187-193.
11. Dwivedi, P.K., Singh, B.P., Kumar Vijay and Walia T. (2011). Socio-economic profile of animal traders and their constraints in following animal welfare practices. *Indian Journal. of Social Research* 52 : 449-454.
12. Dwivedi, P.K., Singh, B.P., Walia T. and Vijay Kumar (2010). Welfare practices for meat animals: a study of animal markets. *Livestock International* 14 : 9-10.
13. Gupta, V. K., Gupta, G., Pathak, M.,Kumar, A. and Vihan, V. S. (2012). Milk-enzyme linked immunosorbent assay for serological diagnosis of Brucella melitensis infection in goats. *Indian Journal of Animal Sciences* 82 : 17–19.
14. Gupta, V. K., Vohra, Jyoti, Kumari, Ranjeeta, Gururaj, K. and Vihan, V. S. (2012). Identification of Brucella isolated from goats using Pst I site polymorphism at Omp2 gene loci. *Indian Journal of Animal Sciences* 82 : 240–243.

15. Kaur, P., Filia, G., Singh, S.V., Patil, P.K., Kumar, G.V.P.P.S. Ravi, Sandhu, K.S., (2011). Molecular epidemiology of *Mycobacterium avium* subspecies paratuberculosis: IS900 PCR identification and IS1311 polymorphism analysis from ruminants in the Punjab region of India. *Comparative Immunology Microbiology Infectious Diseases*. 34 : 163-169.

16. Kharche, S. D., Goel, A. K., Jindal, S. K., Goel, P. and Jha, B. K. (2011). Birth of twin kids following transfer of *in vitro* produced goat embryos. *Indian Journal of Animal Sciences*, 81:46-48.

17. Kadirvel, G., Periasamy, S. and Satish Kumar. (2011). Effect of cryopreservation on Apoptotic-like events and its relationship with cryocapacitation of buffalo (*Bubalus bubalis*) sperm. *Reproduction in Domestic Animals.* DOI:10.1111/J.1439-0531.2011.01818.x-Article first published online: 15 June, 2011.

18. Kadirvel, G., Kathiravan, P, and Satish Kumar (2011). Protein tyrosine phosphorylation and zona binding ability of in vitro capacitated and cryopreserved buffalo spermatozoa. *Theriogenology* 75:1630-1639.

19. Kharche, S.D., Goel, Puja, Jha, B.K., Goel, A.K. and Jindal, S.K. (2011). Factors Influencing *in-vitro* Embryo Production efficiency of Caprine Oocytes: A Review. *Indian Journal of Animal Sciences*, 81: 344–361.

20. Kumar, Ravindra, Kamra, D.N., Agarwal, N. and Chaudhary, L.C. (2011). Effect of feeding a mixture of plants containing secondary metabolites and peppermint oil on rumen fermentation, microbial profile and nutrient utilization in buffaloes. *Indian Journal of Animal Sciences* 81: 488-492.

21. Kumar, Vijay, Singh, B.P. and Kumar, Rajesh (2011). Welfare practices in calf rearing: a comparative study in Madhubani district of Bihar. *Indian Journal of Field Veterinarians* 7 : 29-31.

22. Kumar, Rinesh, Paul, Souvik, Kumar, Sachin, Sharma, Anil Kumar, Gupta, Sweta, Rawat, Ajay Kumar Singh, Chaudhuri, Pallab, Ray, D D, Ghosh, Srikant. (2011). Detection of specific nucleotide changes in the hypervariable region of 16S rDNA gene of Rhipicephalus (Boophilus) microplus and Hyalomma anatolicum anatolicum. *Indian Journal of Animal Sciences.* 81 :1204-1207.

23. Kumar, Sachin, Paul, Souvik, Sharma, Anil Kumar, Kumar, Rinesh, Tewari, Shashi Shankar, Pallab Chaudhuri, D.D. Ray, Ajay Kumar Singh Rawat and Srikant Ghosh. (2011). Diazinon resistant status in Rhipicephalus (*Boophilus*) microplus collected from different agro-climatic regions of India. *Veterinary Parasitology*, 181 :274–281.

24. Malik, Y. S., D. Singh, *et al.* (2011). Occurrence of dual infection of peste-des-petits-ruminants and goatpox in indigenous goats of Central India. *Transbound Emerg Dis* 58 : 268-273.

25. Mandal, Ajoy, Agrawal, N., Nigam, Puja., Sharma, D. K., Roy, R. (2011). Studies on susceptibility of *Haemonchus contortus* in Jakhrana goats. *Indian Journal of Animal Sciences*, 81 : 149-152.

26. Mandal, Ajoy, Sharma, D. K., Roy, R.. (2012). Genetic and environmental influences on faecal nematode egg counts of Jamunapari goats in India. *Veterinary Record*, 170: 337.

27. Mandal, Ajoy, Gopal Dass, P.K. Rout and R. Roy (2011). Genetic parameters for direct and maternal effects on post-weaning body measurements of Muzaffarnagari sheep in India. *Trop Anim Health Prod* 43 : 675-683.

28. Mandal, Ajoy, Gopal Dass, P.K. Rout and R. Roy (2012). Effect of environmental factors on reproductive performance of Muzaffarnagari sheep. *Indian Veterinary Journal*, 89: 73-74.

29. Mishra, A. K., Rawat, M and Abhisek (2011). Characterization and assessment of in vitro lytic activity of Staphylococcus aureus phage SA4. *Indian Veterinary Journal* 88 : 58-60.

30. Mishra, A. K., Rawat, M., Verma, R. and Abhisek (2011). Immunoreactivity of sera of calves vaccinated with Haemorrhagic septicaemia vaccine to outer membrane proteins of *Pasteurella multocida* (B:2) strain P52. *Indian Journal of Veterinary Research* 20 :8-11.

31. Mukherjee, Reena and Sharma, Nitika (2011). Development of non antibiotic and preventive measures against bovine mastitis. *Livestock International*, 15 : 6.

32. Mukherjee, Reena and Sharma, Nitika (2011). Prevention and treatment of bovine mastitis with non conventional therapeutic agents. *Indian Journal of Field Veterinarians*, 6 : 69-70.

33. Narula, H. K., Gopal Dass, Ajay Kumar and P. R. Sharma (2011). Wool yield and quality of Magra sheep under arid conditions. *Indian Veterinary Journal* 88: 53-55.

34. Pawaiya RVS, Lal Krishna and Ram Kumar (2011). Genes responsible for cancer: a review. *Indian Journal of Animal Sciences* 81 : 1–20.

35. Pawaiya, R.V.S., Sharma, A.K., Swarup, D. and Somvanshi, R. (2011). Pathology of mycotic gastritis in a wild indian freshwater/marsh crocodile (Mugger; *Crocodylus palustris*): a case report. *Veterinarni Medicina*, 56 : 135–139.

36. Pawaiya, R.V.S. and Pawan Kumar (2010). Occurrence of neoplastic diseases in small ruminants in India: a review. *Indian Journal of Small Ruminants* 17 : 151-165.

37. Priyadharsini, R., Jindal, S. K., Sharma, D., Ramachandran, N., Kharche, S.D. and Goel, A.K. (2011). Effect of Different Egg Yolk Level on the cryopreservation capability of Jakhrana goat semen. *J Anim Sci Adv*, 1 : 28-37 .

38. Raguvanshi, T.S., Sharma, R.B., Singh, A.V., Singh, B., Singh, S.V. and Dhama, K. (2011). Indigenous milk ELISA kit vis a vis multiple test regime for the estimation of lacto-prevalence of *Mycobacterium avium* subspecies paratuberculosis in goat herds endemic for Johne's disease. *Indian Journal of comparative microbiology, immunology and infectious diseases*. 31: 41-43.

39. Ramesh, D, Saini, M., Swarup, D., Singh, V.K., Upreti, S., Das, A. and Gupta, P.K. (2012). Molecular cloning of IFN-alpha in goat (*Capra hircus*) and black buck (*Antelope cervicapra*) and evaluation of its expression in goat PBM cells. *Indian Journal of Animal Sciences* 82: 40-43.

40. Ranjan, R., Swarup, D. and Patra, R.C. (2011). Changes in levels of zinc, copper, cobalt, and manganese in soft tissues of fluoride-exposed rabbits. *Fluoride* 44:83-88.

41. Rao, S.B.N., Suresh, K.P. and Tripathi, P. (2011). Effect of feeding levels on nutrient utilization and prediction of nutrient requirement of Indian goats. *Indian Journal of Animal Nutrition* 28 : 149-152.

42. Reddy, G. B., Singh, R. et al. (2011). "Molecular characterization of Indian rabies virus isolates by partial sequencing of nucleoprotein (N) and phosphoprotein (P) genes." *Virus Genes* 43 : 13-17.

43. Rout, P.K., Chauhan,K.K., Matika,O., . Bishop, S.C. (2011). Exploring the genetic resistance to natural gastrointestinal nematode infection in Indian goats, *Veterinary Parasitology*. 180 : 315-322.

44. Rout, P. K., Thangraj,K., Mandal, A. And Roy, R. (2012) Genetic Variation and Population Structure in Jamunapari Goats Using Microsatellites, Mitochondrial DNA, and Milk Protein Genes, *The Scientific World Journal*, Article ID 618909, 7 pages,. doi:10.1100/2012/618909.

45. Saini, M., Taggart, M.A., Knopp, D., Upreti, S., Swarup, D., Das, Asit, Gupta, P.K., Niessner, R., Prakash, V., Mateo, R.

and Cuthbert, R.J. (2011). Detecting diclofenac in livestock carcasses in India with an ELISA: A tool to prevent widespread vulture poisoning. *Environmental Pollution* 160 : 11-16. Online doi:10.1016/j.envpol.2011.09.011.

46. Saraswat, S., Jindal, S. K., Priyadharsini, R., Ramachandran, N., Yadav, S., Rout, P. K., Kharche S. D. and Goel, A. K. (2012). The Effect of antioxidants supplementation to cryopreservation protocol on seminal attributes and sperm membrane characteristics in Sirohi goat. *J. Phys. Pharm .Adv.*, 2 : 49-58.

47. Saraswat, S., Priyadharsini, R., Jindal, S. K., Yadav, S., Ramachandran, N., Kharche, S. D. and Goel, A. K. (2012). Effect of antioxidants supplementation at refrigeration temperature on sperm motion characteristics and membrane integrity of Sirohi buck semen. *J. Phys. Pharm. Adv.* 2 : 77-86.

48. Saraswat, Sonia, Jindal, S.K., Ramachandran, N., Yadav, Sushma, Priyadharsini, R. (2012). Standardization of antioxidants fortification in frozen buck semen *Indian Journal of Small Ruminants* 18: 47- 51.

49. Sellappan Selvaraju, Priyadharsini Raju, Somu Bala Nageswara Rao, Subbarao Raghavendra, Sumantha Nandi, Dhanasekaran Dineshkumar, Allen Thayakumar, Shivashanmugam Parthipan and Janivara Parameswaraiah Ravindra. (2011). Evaluation of maize grain and polyunsaturated fatty acid (PUFA) as energy sources for breeding rams based on hormonal, sperm functional parameters and fertility. *Reproduction, Fertility and Development* http://dx.doi.org/10.1071/RD11229.

50. Sharma, D. K. , Mandal Ajoy, Singh, S.K. (2011) Coccidian infection of Barbari Kids: The effect on growth performance. *Journal of Veterinary Parasitology*, 25 :143-145.

51. Shivasharanappa, N., K. Gururaj, D.K.Sharma, G.B. Manjunatha Reddy and V.S.Vihan. (2011). Acute hepatic and pneumonic cysticercosis in Barbari goats. *Indian J. Vet. Pathol.*, 35 : 80-81.

52. Shivasharanappa, N., Reddy, G.B. Manjunatha, Sharma, Nitika., Gupta, V.K. (2011). Parasitic encephalitis caused by larvae of *Oestrus ovis* in Sirohi goat *Indian Journal of Veterinary Pathology* 35 : 204-220.

53. Shivasharanappa, N., Singh, R. Singh K.P. and Madhu, B.P. (2011). NK cell and macrophage activity in experimentally induced rabies in mice. *Indian J. Vet. Pathol.*, 35 : 159-161.

54. Singh, A. V., Singh, S. V. et al. (2011). High prevalence of *Mycobacterium avium* subspecies paratuberculosis ('Indian bison type') in animal attendants suffering from gastrointestinal complaints who work with goat herds endemic for Johne's disease in India." *Int J Infect Dis* 15 : e677-683.

55. Singh, A.V., Singh,S.V., Singh,P.K., Sohal,J.S., Mahour, K. (2010) Sero-surveillance of *Mycobacterium avium* subspecies paratuberculosis infection in domestic livestock in north India using indigenous absorbed ELISA test. *Journal of Advance Laboratory Research Biology*. 1 : 1-5.

56. Singh, A.V., Singh, S.V., Sohal, J.S., Singh, P.K., (2010). Genotype profiles of Mycobacterium avium subspecies paratuberculosis recovered from suspected and Crohn's disease patients in India. *The Journal of Communicable Diseases.* 42 : 91-100.

57. Singh, P. K., Singh, S. V.,Singh, M. K.,Saxena, V. K., Singh, A. V.,Sohal, J. S. (2012) Genetic analysis of MHC Class II DRB gene in an endangered Jamunapari breed of goats *IJBT* 11 : 220-223.

58. Singh, P. K., S. V. Singh, et al. (2012). "Effect of genetic variation in the MHC Class II DRB region on resistance and

susceptibility to Johne's disease in endangered Indian Jamunapari goats." *Int J Immunogenet*.1-7.

59. Singh, S. V., P. K. Singh, M. K .Singh, A. V. Singh and J. S. Sohal (2012). Therapeutic potential of Jhone's disease vaccine: A follow up post vaccination study in a goat herd of endangered Jamunapari breed, naturally infected with *Mycobacterium avian* subspecies Paratuberculosis. *International Journal of Livestock production* 2 : 192-204.

60. Singh, S. V., A. V. Singh, et al. (2011). Molecular identification and characterization of *Mycobacterium avium* subspecies paratuberculosis in free living non-human primate (*Rhesus macaques*) from North India. *Comp Immunol Microbiol Infect Dis* 34 : 267-271.

61. Singh, S.V., M. Solanki, A. Kumar, P. K. Singh, A.V. Singh, B. Singh, J. S. Sohal (2011). Comparative evaluation of improved 'Modified Microscopic Test' with traditional microscopy, indigenous ELISA kit, fecal and blood PCR for the diagnosis of *Mycobacterium avium* subs paratuberculosis in goat herd endemic for Johne's disease. *Research & Review: A Journal of Life Science (STM Journal)* 1: 8-15.

62. Singh, Shiv Pratap, Hooda, O.K., Kundu, S.S. and Singh, Sohanvir (2012). Biochemical changes in heat exposed buffalo heifers supplemented with yeast *Tropical Animal Health and Production* http://dx.doi. org/10.1007/s 11250-012-0075-7.

63. Sood, Richa, Swarup, D, Bhatia, S, Kulkarni, D.D., Dey, S., Saini, M. and Dubey, S.C. (2012). Antiviral activity of crude extracts of *Eugenia jumbolana* Lam. Against highly pathogenic avian influenza (H5N1) virus. *Indian Journal of Experimental Biology* 50: 179-186.

64. Tripathi, M.K. and Karim, S.A. (2011). Effect of yeast culture supplementation on live weight change, rumen fermentation, ciliate protozoa population, microbial hydrolytic enzymes status and slaughtering performance of growing lambs. *Livestock Science*.135: 17-25.

65. Tripathi, M.K., Mondal, D., Somvanshi, R. and Karim, S.A. (2011). Hematology, blood biochemistry and tissue histopathology of lambs maintained on diets containing an insect controlling protein (Cry1Ac) in Bt-cottonseed. *Journal of Animal Physiology and Animal Nutrition*. 95 : 545-555.

66. Tripathi, M.K., Tripathi, P. and Karim, S.A. (2011). Nutrition and feeding of lambs for mutton production under tropical climates. *Indian Journal of Small Ruminants*. 17: 135-150.

67. Verma, A. K. and Banerjee, R. (2012). Low-sodium meat products: Retaining salty taste for sweet health. *Critical Reviews in Food Science and Nutrition* 52 : 72-84.

68. Verma, A. K., Banerjee, R. and Sharma, B. D. (2012). Quality of low fat chicken nuggets: Effect of sodium chloride replacement and added chickpea (Cicer arietinum L.) hull flour. *Asian-Australasian Journal of Animal Sciences* 25 : 291- 98.

Popular articles

Banerjee R and Verma A K. (2011). Eco-friendly packaging of meat and meat products: A Review. Indian Food Packer 65(3): 44-48.

Banerjee R, Verma A K, Das A K and Rajkumar V. (2011). Food safety in meat industry: Indian prospects. Indian Food Industry 30(2): 33-43.

Bhusan, S. (2011). Genetic improvement of Jakhrana goats for milk production. CIRG News, Vol. VI, p 6.

Dinesh Kumar Sharma and Souvik Paul (2011). Laghu rumanthi pashuon ke pachan tantra ke gol krimi sankraman prabandhan ke vaikalpic upaya. Pashudhan. Vol. 2(1), 32-35.

Goel, A.K. and Kharche, S.D. (2011). Oestrus Synchronization: A Farm Management Tool for Enhancing Goat Production. Goat News 6 (Jan-June 2011) pp 5-6.

Gopal Dass (2011). Birth of triplet lambs in Muzaffarnagaru sheep: Boom for mutton production in India. Goat News (English magazine) of CIRG, Vol. VI , Issue January-June, 2011, page: 2.

Gopal Dass (2011). Muzaffarnagari Bhedon main chayan suchkank dwara sudhar. Ajamukh (Hindi magazine) of CIRG, 24th issue, January-June, 2011, page: 5-6.

Gopal Dass (2011). News entitled "Birth of triplet lambs in Muzaffarnagari sheep at CIRG" Published in Amar Ujala, Dainik Jagran, Kalptaru Hindustan and Akinchan Bharat (five news papers) on dated: 10.03.2011.

Kumar Ravindra and Kushwaha RB. (2011) Use of oxytocin in dairy animals. Indian dairy man 63 (4): 44-48.

Kushwah, Tanuja., Tripathi, M.K., Sharma, D.K., (2011). Nutrition interaction with GIN parasitism. CIRG News. 6: 3-4.

Kushwah, Tanuja., Tripathi, M.K., Tripathi, Prabhat., (2011). Energy and Protein requirement of early growing kids. CIRG News. 6: 5-6.

Mishra A K, Rawat M and Abhisek, (2011). Phage therapy: an alternative to antibiotic therapy. Livestock Line 5 (9):44-47.

Ramachandran, N., Singh, S.K., and Tripathi, M.K., (2011). Natural probiotic reduced weaning stress in kids. CIRG News. 6: 4-5.

Sharma D.K. and Tiwari, H. A.(2011) Cat Flea *(Ctenocephalides felis felis)* Infestation in Goats. Vet Scan, Vol. 6(2), Article 96.

Souvik Paul, Mrityunjay Mandal, Rupa Boral and Maj. Deepak Verma (2011). A review of Microarray and its applications in Parasitology. Livestockline, June 2011, 14-18.

Souvik Paul, Mrityunjay Mondal and Rupa Boral. (2011). Bovine Neosporosis- A review. The North-East Veterinarian, Vol. XI, No. 1, 32-34.

Souvik Paul, Rupa Boral, Mrityunjay Mandal and Maj. Deepak Verma (2011). Engineered antibodies- A review. Livestockline. August 2011, 24-29.

Vaswani S, Kumar Ravindra, Kumar V, Anand M and Roy D. (2011)Strategic feeding of high yielding dairy animals. Indian Dairyman 63 (11): 62-65.

Lead/ Invited Papers in National and International Conferences

Agnihotri M K, Arun Kumar Verma and Rajkumar V. (2011). Sustainable animal products production for food security. Souvenir. National Seminar on "Vet for Health; Vet for Food; Vet for the planet" held on November 19-21, 2011, at AP Shinde Auditorium, NASC Complex, PUSA, New Delhi.

Ashok Kumar (2012). Current status of small ruminant diseases and their containment in India. National Seminar on "Animal Disease control and healthy livestock production, Organised by Range Management Society of India and Department of Animal Husbandry Lucknow at IGFRI, Jhansi, U.P. (22 March, 2012).

Ashok Kumar (2012). National Conference on "Emerging trends in biotechnology and pharmaceutical Research. Mangalaytan University, Aligarh, Mathura (18-19 Feb 2012).

Ashok Kumar (2011). Quality and standardization of herbal drug in India . National seminar on conservation, cultivation and sustainable utilization of medicinal and herbal plants . R. B. S. College, Agra (26-27 Feb, 2012).

Ashok Kumar and Nitika Sharma (2012) Approches for nutritional management of metabolic diseases in animals . National Training on "Advances in Nutrient use efficiency in livestock production system" (28 Jan -10 Feb 2012).

Ashok Kumar and V K Gupta (2012). Ethnoveterinary Medicine and approaches for scientific validation in animal diseases. 30th ISVM convention and National symposium on "Animal Health vis-s-vis Animal welfare with application of biotechnology with special references to North Eastern Region" Aizwal (Mizorum) 1-3 Feb 2012.

Ashok Kumar, Souvik Paul and Manjunatha Reddy, G.B (2012) Pet animal parasites: Diagnosis, Treatment and Control . XXII National congress ov veterinary Parasitology: from basic to molecular techniques at College of Veterinary Sciences and A.H., Mathura (15-16 March 2012).

Chaudhary, U.B., T.K. Dutta, M.K. Tripathi, P. Tripathi (2011). Stall feeding system in small ruminant future perspective. Proceeding of national seminar on prospect and retrospect of small ruminant and rabbit production contribution to socio-economic security. Organized by ISGPPU on 7th -9th December 2011.

Goel A.K. (2011). Enhancing Reproductive Efficiency in Small Ruminants. In: Souvenir cum Compendium. National Seminar on Prospects and Retrospect of Small Ruminant and Rabbit Production, ISSGPU, Avikanagar at Jaipur 7-9 December, 2011 pp. 91 (II-L1-1).

Goel A.K. (2011). Reproductive Biotechnologies for Improving Fertility and Production in Small Ruminant. In: Book of Abstracts, International Conference on Emerging Trends on Food and Health Security in cold desert. Defence Institute of High Altitude Research (DIHAR), Defence Research and Development organization (DRDO), Leh–Ladakh (JK), 23-25 September, 2011 pp. 47- 48.

Goel, A. K. and Ramachandran, N. (2011). Recent reproductive techniques for improving goat and sheep production. Lead paper In: compendium of lead papers and abstracts of National Seminar on Sheep and Goat production held at Sheep Breeding Research Station of TANUVAS, Sandynallah, The Nilgiris on 28-29th December, 2011. pp 83-102.

Kharche, S.D. (2011). Goat production in India and its development strategies in Zambia. In a Seminar on "Improved village/Rural Poultry and Goat Production" on 16th November, 2011 at Pamodzi Hotel in Lusaka, Zambia, organized by GART in collaboration with the Ministry of Agriculture and livestock and Indian High Commission of Zambia.

Kharche, S.D. and P. Raju. (2011). In-vivo and in-vitro production of embryos for rapid multiplication and conservation of species. In: Souvenir of XXVII Annual Convention of ISSAR and National Symposium on Reproductive Biotechnologies for augmenting Fertility and conservation of Animal Species with special reference to North Eastern Hill Region, September 27-29, 2011 at College of Veterinary Science & A. H. CAU, Selesih, Aizawl, Mizoram, pp. 36-47.

Kharche, S.D., Birade, H.S., Shelar, R.R. and Amle, M.B. (2012). Parthenogenesis : A potential tool in Reproductive Biotechnology of Goat. In a state symposium on Recent advances in reproductive technologies and obstetrical procedures for augmenting fertility in farm animals, organized by Mahavet Satara, ISSAR Maharashtra Chapter on 5th February, 2012, pp. 37-48.

Kumar A and V.K. Gupta. (2011). A Status paper on Animal Brucellosis in India. Indian Council of Medical Research, New Delhi.

Manjunatha Reddy, G.B. (2012). Quantitative gene expression studies using real time PCR. National training programme on 'Advances in nutrient use efficiency in livestock production system' from Jan 28-Feb 10, 2012, CIRG, Makhdoom.

Patil N V, Ashok Kumar , Ashok Kumar and Rajan Gupta (2011). Nutrient supplementation for augmentation in health in small ruminats. National Seminar on prospects and retrospect of small ruminants and rabbit production : contribution to socio economic security . CSWRI, Avikanagr (7-9 Dec 2011)

Rai, B., Singh, M. K., Ramachandran N. and Jindal, S. K. (2011). Goat production systems in context of socio economic status of goat keepers in India. Management interventions for higher productivity of goats. In : Lead paper, FGM.10. Proceedings of National Symposium on Emerging management concepts for sustainable livestock and poultry production and XIX Annual Convention of ISAPM held at GADVAS, Ludhiana on November, 2-4, 2011. pp 108-114.

Sharma, D.K., Souvik Paul and Manjunath Reddy, G.B. (2012). Parasite control in farm animals: An integrated approach. at XXII national Congress of IAAVP and National Symposium on Integrated Research Approaches in Veterinary Parasitology: From basic to Molecular Techniques. Organised by IAAVP at DUVASU, Mathura during 15th-17th March, 2012.

Sharma, R. B. (2011). Prospects of goat milk and meat processing in India. National Conference on Newer Advances in Food Science and Technology held at P.G. Department of Food Technology, Faculty of Engineering & Technology, R.B.S.College, Bichpuri, Agra during 05-06 March, 2011.

Singh, M. K. and S. K. Singh. (2012). Perspectives of small Ruminant production in India with reference to Food Security and Climate Change". Proceedings of IX Annual Convention of Society for Conservation of domestic Animal Biodiversity and National Symposium on Role of Indigenous Animal-Genetic Resources in Rural Food Security Vis-a Vis Climate Change on February 24-25m 2012,pp107-116.

Singh M K and S K Singh (2011). Breeding Strategy for Chevon Production. In proceedings of National Seminar on Prospects and Retrospect of Small Ruminant and Rabbit Production: Contribution to Socio-economic Security held on December 7-9,2011 at Jaipur, pp 5-10.

Singh, S.V (2011). Molecular diagnosis and control of economically important chronic infections of public health significance in domestic ruminants. XVIII Annual convention f Indian Society of Veterinary Immunology and Biotechnology (ISVIB) & National Symposium on Effective utilization of translational research platforms for animal biotechnology, held at SDAU, Dantiwada, Gujarat, 12 to 14, Dec., 2011. Page 56-63.

Swarup, D, Ashok Kumar and P K Rout (2011) Small ruminant's health concerns and health delivery system in India . National Seminar on prospects and retrospect of small ruminants and rabbit production : contribution to socio economic security . CSWRI, Avikanagar (7-9 Dec 2011).

Radio / T.V. Talk

Ashok Kumar (2011) Live phone in programme on Animal Health and control at AIR Mathura on 24-12-2011.

Ashok Kumar (2011) Radio talk on Pashpalan and Pashu rogoan ka nidan , Live programme on AIR Mathura on 4-5-2011.

Kharche S.D. (2011). A TV talk/interview was given on Goat production to a local TV channel Zambia National Broadcasting Corporation (ZNBC) on 16th November, 2011 at Pamodzi Hotel in Lusaka, Zambia.

Rai, B. (2011). Radio talk on Brajanchal ke liye upukt bakre ki naslen aur unki vishestaen, Live programme on AIR Mathura on 27-7-2011.

Books / Bulletins / Manuals/ Chapters/ Compendium

Chaudhary, U.B. and Kumar, Ravindra. (2012) Cultivation of rumen microbes. Pp 80-83 In : National training on "Advances in nutrient use efficiency in Livestock production system" held in CIRG From Jan 28-Feb 10, 2012.

Chaudhary, U.B., Dutta, T.K. and Kuma,r Ravindra. (2012) Strategies to reduce methane production in livestock. Pp 70-73 In : National training on "Advances in nutrient use efficiency in Livestock production system" held in CIRG From Jan28-Feb 10,2012.

Chaudhary, U.B., Gupta, R. and Kumar, Ravindra. (2012) Role of defaunation in livestock productivity . Pp 74-79 In : National training on "Advances in nutrient use efficiency in Livestock production system" held in CIRG From Jan28-Feb 10, 2012.

Chaudhary, U.B. and M.K. Tripathi(2011) Feeding of small ruminants. Book chapter in Animal nutrition advancements in feeds and feeding of livestock. Edited by Lokesh Gupta and published by AGROBIOS (INDIA).

Bhusan, S. (2011). Goat Rearing in Bundelkhand: Problems and Solutions (Hindi). Proceeding in National Symposium of 13th Rashtriya Krishi Vigyan Gosthi held on 21–23 January, 2011 at NRC on Agroforestory, Jhansi (UP).

Chaudhary, U.B., Dutta, T.K., Tripathi, M.K., Tripathi, P., (2012). Stall feeding system in small ruminants: Future perspectives. In. Trends in Small Ruminant Production: Perspectives and Prospects (Eds: Sahoo, A., Sankhyan, S.K., Swarnkar, C.P., Shinde, A.K., Karim, S.A.), Satish Serial Publishing House, Delhi, India. pp 325-346.

Chaudhary, U.B., Tripathi, M.K. (2011). Feeding of small ruminants. In: Animal Nutrition-Advancement in Feeds and Feeding of Livestock. (Eds: Lokesh Gupta and Singhak, K.K.). Agrobios (India) Publisher, Jodhpur. pp 81-102.

Goel, A.K. (2011). Techniques for Enhancing Reproductive Efficiency in Small Ruminants In Text Book: Trends in Small Ruminant Production: Perspective and Prospects (Eds. A. Sahoo, SK Sankhyan, CP Swarnkar, AK Shinde and SA Karim), Satish Serial Publishing House, Delhi, India, ISBN 978-93-81226-10-0 pp. 83-114.

Gupta, V. K. and Ashok Kumar .(2011). Neonatal mortality in small ruminants: Issues and management. In Trends in Small Ruminants Production: Perspective and Prospects. By Satish Serial Publishing House, New Delhi, pp409-420.

Gupta V. K. (2011). Immunological Indicators Traits for Analyzing Disease Resistance Traits in Livestock. In: Laboratory Manual on Genetic dissection of complex trait analysis with reference to genetic resistance to GIN in goats. By CIRG, Makhdoom. pp64-70.

Jindal, S.K. and Priyadharsini Raju. (2011). Male Reproductive Biotechnology of Goats - Advances and Constraints. Trends in Small Ruminant Production Perspectives and Prospects. (Eds. A. Sahoo, SK Sankhyan, CP Swarnkar, AK Shinde and SA Karim), Satish Serial Publishing House, Delhi, India, ISBN 978-93-81226-10-0 pp.

Kumar Ravindra and Chaudhary, U.B. (2012) Ruminal methane mitigation using plant secondary metabolites- A new perspective. Pp 6-10 In : National training on "Advances in nutrient use efficiency in Livestock production system" held in CIRG From Jan28-Feb 10,2012.

Kumar Ravindra and Vaswani S. (2012). Recent advances in vitamin nutrition of livestock . Pp 11-17 In : National training on "Advances in nutrient use efficiency in Livestock production system" held in CIRG From Jan28-Feb 10,2012.

Narayan Dutta and Tripathi, M.K. (2012). Recent Advances in Feed Evaluation. In: Animal Nutrition: Advances & Developments (Eds. U.R. Mehra, P. Singh and A.K. Verma) Satish Serial Publishing House, New Delhi, India, pp.691-706.

Sharma, D. K. (2011). Indicator traits to nematode resistance in small ruminants. Laboratory Manualpublished for National Training Course on "Genetic dissection of Complex trait analysis with special reference to genetic resistance to GIN in goats. Organized by Central Institute For Research on Goats, Makhdoom, Farah-281122(UP) .

Sharma, D. K., Paul, Souvik and Reddy Manjunath G. B. (2012). Parasite control in farm animals: An Integrated approach. Integrated Research Approach in Veterinary Parasitology edited by Daya Shankar, Jitendra Tiwari, Amit Kumar Jaiswal and Vikrant Sudan published by Department of Parasitology, College of Veterinary Science and Animal Husbandry, UPP Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwa Vidyalaya Evam Go Anusandhan Sansthan(DUVASU) Mathura-281001.

Sharma, R.B. (2012). Nutrition and Milk Quality of Animals.In Book: National Training on Advances in Nutrient Use Efficiency in Livestock Production System. January 28 - February 10, 2012 Published by C.I.R.G. Makhdoom. pp. 84-89.

Tripathi, M.K., Tripathi, Prabhat., Dutta, T.K., Karim, S.A., (2011). Nutritional enhancement of pre- and post weaning growth in small ruminants. In. Proc. Prospects and Retrospect of Small Ruminant and Rabbit Production: Contribution to Socio-economic Security. Published by ISSGPU, Avikanagar. pp 39-50.

Papers Presented in National and International Conferences

Bhusan, S. (2011). Effect of genetic and non-genetic factors on body weight of Jakhrana kids. Proceeding of International Conference on, "Emerging Trends on Food and Health Security in Cold Deserts" Organized by Defence Institute of High Altitude Research (DRDO), Leh - Ladakh held on 23-25 September,2011 at Leh.

Bhusan, S. (2012). Impact of some genetic and non-genetic factors on milk production of Jakhrana goats. Proceeding of National Symposium on, " " Organized by Society for Conservation of Domestic Animal Biodiversity (SOCDAB) and BAIF development Research Foundation held on 24-25 February, 2012 at Pune.

Chaudhary, U.B., Tripathi, M.K., Dutta, T.K., Gupta, Bhavna and Sirohi, H.V., (2011). Voluntary feed intake and performance of Barbari kids supplemented varying levels of multi organic trace mineral product. 14th Biennial Conference of Animal Nutrition Society of India on "Livestock Productivity Enhancement with Available Feed Resources" from Nov. 2-5, 2011, at GBPUA&T, Pantnagar, India. pp. 213-215.

Chaudhary, U.B., Tripathi, M.K., Gupta, Bhavna., Dutta, T. K. and Sirohi, H.V., (2011). Intake, growth performance, nutrient utilization, rumen fermentation, hematology, blood biochemistry and serum minerals of Barbari Kids fed restricted concentrate under stall supplemented organic or inorganic Zn and Cu. 14th Biennial Conference of Animal Nutrition Society of India on "Livestock Productivity Enhancement with Available Feed Resources" from Nov. 2-5, 2011, at GBPUA&T, Pantnagar, India. pp. 215-218.

Deepak Dwivedi , Ashok Kumar and V K Gupta (2012). Haemolytic Streptococcus Isolates of Goats: Antibiotic and Herbal Sensitivity. 30th ISVM convention and

National symposium on "Animal Health vis-s-vis Animal welfare with application of biotechnology with special references to North Eastern Region" Aizwal (Mizorum) 1-3 Feb 2012.

Dixit A.K. (2011). Ownership Pattern of Small Ruminant population in India. Souvenir cum Compendium National Seminar on Prospects and Retrospect of Small Ruminant and Rabbit Production: Contribution to Socio-Economic Security Organized by Indian Society for Sheep and Goat Production and Utilization, Avikanagar, December 7-9, 2011, pp:87-88.

Gopal Dass and Ajoy Mandal (2012). Evaluation of productivity of Muzaffarnagari sheep under semi-arid zone of western Uttar Pradesh, Published in the compendium of National Symposium on "Role of Indigenous Animal Genetic Resources in Rural Food Security *vis-à-vis* Climate Change" held at BAIF, Pune from February 24-25, 2012, Page No.106.

Gopal Dass, Ajoy Mandal and R. Roy (2011). Production performance of Muzaffarnagari sheep in organized flocks, Published in the compendium of National Seminar on "Prospects and retrospect of small ruminant and rabbit production: Contribution to socio-economic security" and organized by ISSGPU and Central Wool Development Board at Jaipur from December 7-9, 2011, Page No.81.

Gopal Dass, Ajoy Mandal, P. K. Rout and R. Roy (2011). Muzaffarnagari sheep: The best mutton producing breed of India, Published in the compendium of International Conference on "Emerging trends on food and health security in cold deserts" held at DRDO, Leh, Laddakh from September 23-25, 2011, Page No.106-107.

Gupta, Anjali, Tripathi, P., Tripathi, M.K., Dutta, T.K., Chaudhary, U.B., Kumar Ravindra. (2011). Manurial changes in goat faeces during composting and vermi-composting. In. Proc. National Seminar on Prospects and Retrospect of Small Ruminant and Rabbit Production: Contribution to Socio-economic Security, Dec. 7-9, Avikanagar. p121.

Gupta, Rajan, S.P. Tiwari and U.B. Chaudhary (2011). Major research areas under animal nutrition. Proceeding of national seminar on livestock productivity enhancement with available feed resources. Held at G.B. Pant University of agriculture and Technology, Pantnagar.

Gupta, V. K., Kumar, A. and Vihan, V. S. (2011). Evaluation of enzyme linked immuno-sorbent assay for serological diagnosis of Brucella melitensis infection in goat milk. DIHARCON, Leh 24-27 Sep 2011.

Kharche, S.D., Goel, Puja, Jha, B.K., Goel, A.K. and Jindal, S.K. (2011). Parthenogenetic embryo production by ethanol activation of matured caprine oocytes. In : National symposium on Reproductive Biotechnologies for Augmenting Fertility and conservation of animal species with Special Reference to North Eastern Hill Region and XXVII Annual Convention of ISSAR, organized by College of Veterinary Science & AH, CAU, Selesih, Aizawl, Mizorum from 27 to 29th September, 2011.

Kumthekar, S.M., Chikweto, A., Collins, M., Kunkel, B., Louison, B., Derek, T., Pawaiya, R.V.S., Tiwari, K.P., Bhaiyat, M.I., Stone, D. and Sharma, R.N. (2011). Studies on paratuberculosis (johne's disease) in sheep and goats from grenada and carriacou. Research paper presented on Phi-Zeta Research Emphasis Day held at Saint George's University, Saint George's Grenada, West Indies on 17th September, 2011. Abst No. 25.

Kushwah, Tanuja, Gupta, D.L., Tripathi, M.K. and Tripathi, Prabhat (2011). Chemical Constituents Evaluation of Groundnut *(Arachia hyposia)* Hull for Ruminant Feeding. 14th Biennial Conference of Animal Nutrition Society of India on

"Livestock Productivity Enhancement with Available Feed Resources" from Nov. 2-5, 2011, at GBPUA&T, Pantnagar, India. pp. 75-77.

Kushwah, Tanuja., Sharma, D.K., Tripathi, M.K., Tripathi, Prabhat and Rout, P.K. (2011). Effect of Level of Nutrition on Natural Gastrointestinal Nematodes Burden in Barbari Kids. 14th Biennial Conference of Animal Nutrition Society of India on "Livestock Productivity Enhancement with Available Feed Resources" from Nov. 2-5, 2011, at GBPUA&T, Pantnagar, India. pp. 261-263.

Manjunatha Reddy, D.K.Gupta, Souvik Paul, D.K.Sharma and Shivasharanappa (2012). Intestinal Coccidiosis in Kids: A Study on Histopathological Changes" to be submitted to XXII national congress of Indian association for the advancement of veterirnary Parasitology to held at Mathura, from 23-25th, Feb 2012.

Manjunatha Reddy, D.K.Gupta, V.K.Gupta, Souvik Paul, Ashok Kumar and Shivasharanappa (2011). Etio-Pathology of Kid Diarrhoea in Barbari and Jamunapari Goats. National seminar on prospects and retrospect of small ruminant and rabbit production: Contribution to socio-economic security, 7-9th December, 2011, held at Jaipur.

Mohan, B. Singh, K. and Dixit, A.K. (2011). Socio-Economic Status of Goat Farmers in Semi-Arid Zone of Uttar Pradesh. Presented in 6th national Extension Education Congress 2011 on Emerging Models of Technology Application for Agri-rural Development at ICAR Research Complex, Goa on December 17-19, 2011, pp.304.

Narula, H. K. Gopal Dass, P. R. Sharma, Vimal Mehrotra and M. Ayub (2011). Performance evaluation of Marwari sheep in an organized farm under hor arid zone of Rajasthan, Published in the compendium of National Seminar on "Prospects and retrospect of small ruminant and rabbit production: Contribution to socio-economic security" and organized by ISSGPU and Central Wool Development Board at Jaipur from December 7-9, 2011, Page No.86-87.

Nidhi Goswami, Priyanka Raj and Ashok Kumar (2012). Isolation and Characterization of Escherichia coli from caprine pneumonic lungs and antibacterial Activity of Some Plant Extracts and their phytochemical analysis. 30th ISVM convention and National symposium on "Animal Health vis-s-vis Animal welfare with application of biotechnology with special references to North Eastern Region" Aizwal (Mizorum) 1-3 Feb 2012.

Nitika Sharma and Reena Mukherjee (2012). Anti-inflammatory and therapeutic potential of Phyllanthus emblica against bovine sub-clinical mastitis. Submitted to 30 th ISVM National Symposium on Animal Health vis-à-vis Animal Welfare with Application of Biotechnology with Special Reference to North-Eastern Region" held at Aizawl, February 1-3, 2012.

Nitika Sharma, Reena Mukherjee, N. Shivsharanappa and Ashish Srivastava. (2012). Sarcocystis muris – a rare and incidental finding in laboratory mice. Submitted to XXII National Congress of Veterirnary Parasitology NCVP on "Integrated reseach approaches in Veterirnary Parasitology from basic to molecular techniques" held at Mathura, from 15-17th, Mar 2012.

Paul Souvik, Sharma D K and Chaturvedi Vinay (2012). Amprolium resistance among Eimeria spp. infecting goats. Presented in XXII National Conference of Indian Association for Advancement of Veterinary Parasitology and National Symposium, held on March 15-17 2012 at Department of Parasitology, College of Veterinary Science and Animal

Husbandry, UPP Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwa Vidyalaya Evam Go Anusandhan Sansthan (DUVASU) Mathura-281001.

Pawaiya RVS, Chikweto A, Tiwari KP, Inga A, Hegamin-Younger C, Bhaiyat MI and Sharma RN. (2011). Occurrence of canine tumors in Grenada, West Indies (2001-2010): A Retrospective Study. Research paper presented on Phi-Zeta Research Emphasis Day held at Saint George's University, Saint George's Grenada, West Indies on 17th September, 2011. Abst. No. 32.

Pawaiya RVS, Chikweto A, Tiwari KP, Bhaiyat MI and Sharma RN. (2011). Oviductal Adenocarcinoma with Metastasis to Liver in Local Layer Hens. In the compendium of XXVIII Annual Conference of Indian Association of Veterinary Pathologists (IAVP) and National Symposium on "Innovative research approaches for diagnostic pathology" and II annual meeting of the Indian College of Veterinary Pathologists held at Department of Veterinary Pathology, TANUVAS, Chennai, Tamilnadu during Dec. 28-30, 2011. Abst. AP-18.

Prashant Yadav, Ashok Kumar and V. S. Vihan (2012). Endoparasiticidal activity of plant extracts against Haemonchus contortus and relationship with phytochemical constituents. 30th ISVM convention and National symposium on "Animal Health *vis-s-vis* Animal welfare with application of biotechnology with special references to North Eastern Region" Aizwal (Mizorum) 1-3 Feb 2012.

Priyanka Raj and Ashok Kumar (2012). Free radical scavenging activity and Phyto-chemical screening of some medicinal plants. 30th ISVM convention and National symposium on "Animal Health *vis-s-vis* Animal welfare with application of biotechnology with special references to North Eastern Region" Aizwal (Mizorum) 1-3 Feb 2012.

Priyanka Raj, Ashok Kumar and Nitika Sharma. (2012). Free radical Scavenging activity and phytochemical screening of some medicinal plants. Submitted to 30 th ISVM National Symposium on Animal Health *vis-à-vis* Animal Welfare with Application of Biotechnology with Special Reference to North-Eastern Region" held at Aizawl, February 1-3, 2012.

Priyanka Raj, Jyoti Pathak, Ashok Kumar and Nitika Sharma (2012). Phytochemical screening and antioxidant potential of methanolic extract of Annona squamosa, Citrus media and Prunus persica. Submitted to National seminar on "Cultivation, conservation and sustainable utilization of medicinal and herbal plants" held at RBS College, Agra from 25-26 February, 2012.

Parthiban, S., Priyadharsini Raju, Allen Thayakumar, J.P. Ravindra, I.J. Reddy, S.K. Agrawal and S. Selvaraju (2011). Role of Nitric oxide donor and inhibitor on buffalo (Bubalis bubalis) luteal cells function in vitro. National Symposium on Reproductive Biotechnologies for Augmenting Fertility and Conservation of Animal Special References to North eastern hill region. p.232.

Priyadharsini, R., Shivasharanappa, N., Deepika Sharma, and S.K. Jindal. (2011). Effect of different egg yolk level on the cryopreservation capability of Jakhrana goat semen. National Symposium on Reproductive Biotechnologies for Augmenting Fertility and Conservation of Animal Special References to North eastern hill region. p.235.

Priyadarshani, R, Saraswat, S, Yadav, S, Ramachandran, N, Jindal, S.K., Kharche, S.D., and Goel, A.K., (2011). Influence of exogenous antioxidants on motility, membrane integrity and per oxidation of frozen thawed Sirohi Buck spermatozoa. In Technique Bulletin: Reproductive Biotechnologies for Augmenting Fertility and Conservation of Animal Species with

Special Reference to North Eastern Hill Region & XXVII Annual Convention of ISSAR, September 27-29, 2011, CVSc. & AH, CAU, Selesih, Aizawl, Mizoram pp.104.

Raghuvanshi, T.S. and Sharma, R.B. (2011). Influence of season on goat milk composition. In: The Proceedings of National Seminar on Prospects and Retrospect of Small Ruminant and Rabbit production organized by ISSGPU at Jaipur during 7-9 Decmber 2011.

Raghuvanshi, T., Sharma R.B. and Singh S.V. (2011). Estimation pf lacto-prevalence of Mycobacterium avium subspecies paratuberculosis in goat herds endemic for Johne's disease. In: The Proceedings of National Seminar on Prospects and Retrospect of Small Ruminant and Rabbit production organized by ISSGPU at Jaipur during 7-9 Decmber 2011.

Rai, B, M. K. Singh, Ashok Kumar and R. B. Rai.(2012). Milch breed of goat as an Intervention to increase food and livelihood security in Barabanki district of Uttar Pradesh. Proceedings of IX Annual Convention of Society for Conservation of domestic Animal Biodiversity and National Symposium on Role of Indigenous Animal-Genetic Resources in Rural Food Security *Vis-a Vis* Climate Change on February 24-25m 2012, pp.107-116.

Rai, B., Ashok Kumar and M.K. Singh (2011). Intervention of Goats and Goat based technologies for improving Livelihood Security in Barabanki and Raibareilly districts of U.P. In proceedings of National Symposium an emerging Management Concepts for sustainable livestock and poultry production held on 2-4 Nov., 2011 at GADVASU, Ludhiana . pp.259.

Rajkumar, V., Verma, A. K., Arun K. Das, Brijesh K., Apurv, S. and Mahesh, K. (2011). Sweet Lemon (*C.limetta*) Albedo as dietary fiber source on functional quality of goat meat nuggets. *Souvenir. National Seminar on "Vet for Health; Vet for Food; Vet for the planet" held on November 19-21, 2011,* at AP Shinde Auditorium, NASC Complex, PUSA, New Delhi.

Rajkumar, V, Verma, A. K., Arun K. Das, Mahesh Kumar, Brijesh Kumar and Apurv, S. (2011). Antioxidative dietary fiber potential of Gauva (Psidium Guajava L.) powder in Sheep meat Nuggets. Souvenir cum Compendium. National Seminar on "Prospects and Retrospect of Small Ruminant and Rabbit Production: Contribution to Socio-economic Security" held on December 7-9, 2011 at Hotel Royal Orchids, Jaipur, Rajasthan. pp. 145.

Ramachandran, N., Tripathi, M.K., Singh, S.K., Rai, B., Dutta, T.K., and Raj Kumar, V., (2011). Effect of natural probiotic supplement on weaning perfroamnce kids. In : Abstract No. FGM.10. Proceedings of National Symposium on Emerging management concepts for sustainable livestock and poultry production and XIX Annual Convention of ISAPM held at GADVAS, Ludhiana on November, 2-4, 2011. pp. 121-122.

Reddy Manjunath G B. Souvik Paul, Gupta D K, Gupta V K, Shivasharanappa N and Sharma D K (2012). Intestinal Coccidiosis in Kids: A study on histopathological changes. Presented in XXII National Conference of Indian Association for Advancement of Veterinary Parasitology and National Symposium, held on March 15-17 2012 at Department of Parasitology, College of Veterinary Science and Animal Husbandry, UPP Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwa Vidyalaya Evam Go Anusandhan Sansthan (DUVASU) Mathura-281001.

Sharma D K, Paul Souvik and Manjunath Reddy G B (2011). Sheather's Floatation for Detection of Cryptosporidium Oocysts in goats. Presented in Internation Conference on ' Emerging trends on Food

and Health Security in Cold Desert' organized by Defence Institute of High Altitude Research(DIHAR) and Defence Research and Development Organization (DRDO), Leh- Ladakh(J & K).

Sharma D K, Tirpathi P, Paul Souvik, Tirpathi M K, Dutta, T K and Chaudhary U B. (2012). Pasture models and gastrointestinal nematodes infections in goats with respect to condensed tannin contents. Presented in XXII National Conference of Indian Association for Advancement of Veterinary Parasitology and National Symposium, held on March 15-17 2012 at Department of Parasitology, College of Veterinary Science and Animal Husbandry, UPP Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwa Vidyalaya Evam Go Anusandhan Sansthan(DUVASU) Mathura-281001.

Sharma, R. B., Raghuvanshi T. S., Hussain Tahziba and Singh S.V. (2011). Goat milk strengthens the immune system of HIV-positive patients. In: The Proceedings of International Conference on Functional Dairy Foods held at NDRI, Karnal during 16-19 November 2011.

Sharma, R.B. (2011). Manufacture of Shrikhand from Jakhrana goat milk. In: Proceedings of National Seminar on Recent Advances in The Development of Fermented Foods held at BHU, Varanasi, (U.P.) during 8-9 April 2011.

Sharma, R.B. and Singh R. K. (2011). Effect of multiple births on goat milk composition. In: The Proceedings of National Seminar on Prospects and Retrospect of Small Ruminant and Rabbit production organized by ISSGPU at Jaipur during 7-9 Decmber 2011.

Sharma, R.B., Goel, A.K. and Rai, B. (2011). Goat milk composition under field and farm conditions. In: The Proceedings of National Seminar on Recent Advances in The Development of Fermented Foods held at BHU, Varanasi, (U.P.) during 8-9 April 2011.

Singh, M.K., Dikshit, A.K. and Singh, S.K. (2012). Role of livestock in Food and Livelihood Security in Bundelkhand Region Proceedings of IX Annual Convention of Society for Conservation of domestic Animal Biodiversity and National Symposium on Role of Indigenous Animal-Genetic Resources in Rural Food Security *vis-a-vis* Climate Change on February 24-25m 2012, pp.107-116.

Singh, S.V., Raghuvanshi T.S., Sharma R.B., Singh B., Singh A.V., Singh P.K., Kumar A. and Srivastav A. (2011). Real-time estimation of the lacto-presence of Mycobacterium avium subspecies paratuberculosis in mil and milk products originating from goat and cattle herds endemic for Johne's disease. In: The Proceedings of "JDIP Conference oral presentation". JDIP 7th Annual Conference held at New Orleans Louisiana during 10-14 July 2011.

Souvik Paul, Sharma D K and Reddy Manjunath G.B. (2011). First Report of Cryptosporidiosis in Jamunapari and Barbari Goat Kids From India. Presented in International Conference on ' Emerging trends on Food and Health Security in Cold Desert' organized by Defence Institute of High Altitude Research (DIHAR) and Defence Research and Development Organization (DRDO), Leh-Ladakh(J & K).

Swati Chauhan, Ashok Kumar, H A Tiwari and V.S.Vihan (2012). Epidemiology of pneumonia in goats: several factors associates with Caprine pneumonia. 30th ISVM convention and National symposium on "Animal Health vis-s-vis Animal welfare with application of biotechnology with special references to North Eastern Region" Aizwal (Mizorum) 1-3 Feb 2012.

Tripathi, M.K., Kushwah, Tanuja., Tripathi, Prabhat., Rout, P.K., and Sharma, D.K., (2011). Performance, Rumen

Fermentation and Blood Biochemistry of Barbari Kids maintained at varying levels of nutrition. 14th Biennial Conference of Animal Nutrition Society of India on "Livestock Productivity Enhancement with Available Feed Resources" from Nov. 2-5, 2011, at GBPUA&T, Pantnagar, India, pp. 257-260.

Verma, Arun K, Arun K Das, Rajkumar V, Brijesh Kumar, Apurv S and Mahesh Kumar. (2011). Quality evaluation and fatty acid profile of high (Longissimus dorsi) and low (Supraspinatus) value cuts of Barbari Goat meat and their product. Souvenir cum Compendium. National Seminar on "Prospects and Retrospect of Small Ruminant and Rabbit Production: Contribution to Socio-economic Security" held on December 7-9, 2011 at Hotel Royal Orchids, Jaipur, Rajasthan. pp- 144.

HUMAN RESOURCE DEVELOPMENT

Trainings & Short Courses Attended

A.K. Dixit

Completed short term course on Open Source Software/free Software (OSS/FS) Tools in Development of Agricultural Information and Communication Management System.

Research Training -VII on 'Analysis of Animal Science Data using SAS' (NAIP Project: Strengthening Statistical Computing for NARS") by Consortium Partner IVRI during 9-14 January, 2012.

A.K. Goel

Research Training -VII on 'Analysis of Animal Science Data using SAS' (NAIP Project: Strengthening Statistical Computing for NARS") by Consortium Partner IVRI during 9-14 January, 2012.

G.B. Manjunath Reddy

'Genetic dissection of complex trait analysis with special refrence to genetic resistance to GIN in goats. from 15 to 28th November/2011, held at CIRG, Makhdoom, Farah, Mathura.

R.B. Sharma

Research Training -VII on 'Analysis of Animal Science Data using SAS' (NAIP Project: Strengthening Statistical Computing for NARS") by Consortium Partner IVRI during 9-14 January, 2012.

Ravindra Kumar

Research Training -VII on 'Analysis of Animal Science Data using SAS' (NAIP Project: Strengthening Statistical Computing for NARS") by Consortium Partner IVRI during 9-14 January, 2012.

D.K. Sharma

Research Training -VII on 'Analysis of Animal Science Data using SAS' (NAIP Project: Strengthening Statistical Computing for NARS") by Consortium Partner IVRI during 9-14 January, 2012.

Gopal Dass

Research Training -VII on 'Analysis of Animal Science Data using SAS' (NAIP Project: Strengthening Statistical Computing for NARS") by Consortium Partner IVRI during 9-14 January, 2012.

N. Ramachandran

Attended NAIP training on Strengthening Statistical Computing for NARS using SAS software from 16-21st May, 2011 at DUVASU, Mathura.

Saket Bhushan

Research Training -VII on 'Analysis of Animal Science Data using SAS' (NAIP Project: Strengthening Statistical Computing for NARS") by Consortium Partner IVRI during 9-14 January, 2012.

N. Shivasharanappa

Short term course on Open source software/free software tools in development of Agricultural Information and Communication Management System" sponsored by ICAR held at CIRG, Makhdoom from Sept 14-23rd, 2011.

ICAR Winter School training on "Advanced Molecular biology tools used in Animal Disease Diagnosis and Development of New Generation Vaccines" held at GADVASU, Ludhiana from Oct 3rd to 23rd, 2011.

NAIP Training course on "Genetic Dissection of complex traits analysis with special reference to genetic resistance to GIN in goats" from 15-28 Nov 2011 held at CIRG, Makhdoom, Farah, Mathura.

Nitika Sharma

Research Training -VII on 'Analysis of Animal Science Data using SAS' (NAIP Project: Strengthening Statistical Computing for NARS") by Consortium Partner IVRI during 9-14 January, 2012.

NAIP sponsored Training Course on "Advances in nutrient use in efficiency in livestock production system" organised at C.I.R.G, Makhdoom, Mathura from January 28 to February 10, 2012.

Vijay Kumar

Senior Certificate Course in Agricultural Statistics and Computing at IASRI, New Delhi from 20 June – 20 Aug. 2011.

Research Training -VII on 'Analysis of Animal Science Data using SAS' (NAIP Project: Strengthening Statistical Computing for NARS") by Consortium Partner IVRI during 9-14 January, 2012.

Souvik Paul

ICAR sponsored Training on " Advances in Veterinary Entomology and Acarology" conducted by CAFT in Veterinary Parasitology, by Veterinary College, Hebbal, Bangalore from 21.11.2011 to 11.12.2011.

Research Training -VII on 'Analysis of Animal Science Data using SAS' (NAIP Project: Strengthening Statistical Computing for NARS") by Consortium Partner IVRI during 9-14 January, 2012.

A.K. Mishra

Research Training -VII on 'Analysis of Animal Science Data using SAS' (NAIP Project: Strengthening Statistical Computing for NARS") by Consortium Partner IVRI during 9-14 January, 2012.

S.D. Kharche

Research Training -VII on 'Analysis of Animal Science Data using SAS' (NAIP Project: Strengthening Statistical Computing for NARS") by Consortium Partner IVRI during 9-14 January, 2012.

National Training on "Embryonic and Spermatogonial Stem Cell Biology" (21 days), sponsored by National Agricultural Innovative Project (NAIP), Organized at National Dairy research Institute (Deemed University) Karnal.

P. Raju

Winter school training (22. Nov to 12, Dec, 2011) at National Institute of Animal Nutrition and Physiology on Functional Genomic Approaches for Enhancing Fertility in Livestock.

Khushyal Singh

Research Training -VII on 'Analysis of Animal Science Data using SAS' (NAIP Project: Strengthening Statistical Computing for NARS") by Consortium Partner IVRI during 9-14 January, 2012.

Trainings /Workshops Organized

National training on "Advances in Nutrient use Efficiency in Livestock Production System" from Jan.28-Feb.10, 2012 in NFR&PT Div. CIRG, Makhdoom.

Training Programme on 'Researchers' Training-VII:Analysis of Animal Science Data using SAS' under the NAIP Project ''Strengthening Statistical Computing for NARS'' organized by at Central Institute for Research on Goats, Makhdoom, Mathura by Consortium partner Indian Veterinary Institute, Izatnagar during 9-14 January, 2012.

Gene Sequences Published

N. Shivasharanappa

Rabies virus isolate ICAD1-RB phosphoprotein (P) mRNA, partial cds, PubMed. ACCESSION Nos. GU363385, GU363417, GU363407.

Conferences and Seminars Attended

A.K. Dixit

6th National Extension Education Congress on Emerging Models of Technology Application for Agri-Rural Development Held at ICAR Research Complex for Goa, December 17-19.

Lecture of Dr. M. Blummel, ICRISAT, Hyderabad on Feed at the interface of livestock.

Productivity and environment: rumen digestion on 7-8th February, at CIRG, Makhdoom, Farah, Mathura.

Stakeholders meeting for consultation on XII Plan & Goat Mission on February 06, 2012 at CIRG, Makhdoom.

4th Quarterly Hindi Workshop held on 29.3.2012 at CIRG, Makhdoom.

A.K. Goel

National Seminar on 'Recent Advances in the Development of Fermented Foods', Centre of Food Science and Technology, Institute of Agriculture Sciences BHU, Varanasi 8-9, April, 2011.

International Conference on 'Emerging Trends in Food and Health Security in Cold Desert', Defense Institute of High Altitude Research (DIHAR). Defense Research & Development Organization (DRDO), Leh-Ladakh (JK) 23-25, September, 2011.

National Seminar on 'Prospect and Retrospect of Small Ruminant and Rabbit Production: Contribution to Socio-economic Security', ISSGPU and Central Wool Board, Rajasthan, at Jaipur 7- 9, December, 2011.

National Seminar on' Sheep and Goat Production', organized by CAPS, TANUVAS, Chennai at Sheep Breeding Research Station, Sandynallah, the Nilgiris (Otty) from 28-29 December, 2011(World Veterinary Day Celebrations - 2011).

National Stakeholders Consultation Meeting at NAARM, Hyderabad on 14th March, 2012 (Represented Institute on the behalf of Director, CIRG, Makhdoom).

First Quarterly Hindi Workshop held on 30.6.2011 at CIRG Makhdoom.

Second Quarterly Hindi Workshop held on 27.9.2011 at CIRG Makhdoom.

Fourth Quarterly Hindi Workshop held on 29.3.2011 at CIRG Makhdoom.

A.K. Verma

National Seminar on "Prospects and Retrospect of Small Ruminant and Rabbit Production: Contribution to Socio-economic Security" held on December 7-9, 2011 at Hotel Royal Orchids, Jaipur, Rajasthan.

Ashok Kumar

Global Conference on women in Agriculture organized by ICAR and Asia –Pacific Association of agriculture Research Institutions (APAARI) at NASC New Delhi (13-15 March 2012).

National Conference on "Emerging trends in biotechnology and pharmaceutical Research. Mangalaytan University Aligarh, (18-19 Feb 2012).

National Seminar on "Animal Disease Control and Healthy Livestock Production, Organised by Range Management Society of India and Department of Animal Husbandry Lucknow at IGFRI, Jhansi (22 March 2012).

National symposium on "Animal Health *vis-a-vis* Animal welfare with application of biotechnology with special references to North Eastern Region" and 30th ISVM convention Aizwal (Mizorum) 1-3 Feb 2012.

B. Rai

National Symposium on Emerging Management Concepts for Sustainable Livestock and Poultry Production and XIX Annual Convention of ISAPM held at GADVAS, Ludhiana on November, 2-4, 2011.

Braj Mohan

1st Quarterly Hindi Workshop held on 3.6.2011 at CIRG, Makhdoom.

Hindi Shodh Patra Pratiyogita at CIRG, Makhdoom on 24.9.2011.

2nd Quarterly Hindi Workshop held on 27.9.2011 at CIRG, Makhdoom.

6th National Extension Education Congress-2011 on Emerging Models of Technology Application for Agri-rural Development at ICAR Research Complex Goa on Dec. 17-19, 2011.

4th Quarterly Hindi Workshop held on 29.3.2012 at CIRG, Makhdoom.

D.K. Sharma

XXII National Conference of Indian Association for Advancement of Veterinary Parasitology and National Symposium, held on March 15-17 2012 at Department of Parasitology, College of Veterinary Science and Animal Husbandry, UPP Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwa Vidyalaya Evam Go Anusandhan Sansthan(DUVASU) Mathura.

International Conference on Emerging Trends of Food and Health Security in Cold Desert organized by by Defence Institute of High Altitude Research (DIHAR) and Defence Research and Development Organization (DRDO), Leh- Ladakh (J&K) India held on 23-25 Sep. 2011 at DIHAR Leh-Ladakh.

Devendra Swarup

National Seminar on "Prospects and Retrospect of Small Ruminant and Rabbit Production: Contribution to Socio-economic Security" held on December 7-9, 2011 at Hotel Royal Orchids, Jaipur, Rajasthan.

G.B. Manjunatha Reddy

13th National conference of Assicication for Prevention and Control of Rabies in India (APCRI), from 9th-10th July, 2011, held at Chennai.

National Seminar on 'Prospects and Retrospect of Small Ruminant and Rabbit Production: Contribution to socio-economic security', 7-9th December, 2011 at Hotel Royal Orchids, Jaipur, Rajasthan.

Gopal Dass

National Symposium on "Role of Indigenous Animal Genetic Resources in Rural Food Security *vis-à-vis* Climate Change" held at BAIF, Pune from February 24-25, 2012.

Khushyal Singh

1st Quarterly Hindi Workshop held on 3.6.2011 at CIRG, Makhdoom.

Hindi Shodh Patra Pratiyogita at CIRG, Makhdoom on 24.9.2011.

2nd Quarterly Hindi Workshop held on 27.9.2011 at CIRG, Makhdoom.

6th National Extension Education Congress-2011 on Emerging Models of Technology Application for Agri-rural Development at ICAR Research Complex Goa on Dec. 17-19, 2011.

4th Quarterly Hindi Workshop held on 29.3.2012 at CIRG, Makhdoom.

M.K. Tripathi

14th Biennial Conference of Animal Nutrition Society of India on "Livestock Productivity Enhancement with Available Feed Resources" from Nov. 2-5, 2011, at GBPUA&T, Pantnagar, India.

N. Ramachandran

Annual Review Meeting of the Network Project on "Adaptation of Livestock to Impending Climatic Changes through Shelter Management" held on 6th July 2010 at NDRI, Kamal.

National Symposium on Emerging Management Concepts for Sustainable Livestock and Poultry Production and XIX Annual Convention of ISAPM held at GADVAS, Ludhiana on November, 2-4, 2011.

R. Priyadharsini

XX Annual Conference of Society of Animal Physiologist of India and International Symposium on Advances in Physiologic Research for sustainable development of livestock and poultry production. 2-4 November, 2011. West Bengal University of Animal & Fishery Sciences, Kolkata.

Ravindra Kumar

Global Conference on Women in Agriculture held on 13-15 March,2012 and displayed the exhibits in the Innovation Market Place cum Exhibition at IARI Mela ground, New Delhi.

R.B. Sharma

National Seminar on Recent Advances in The Development of Fermented Foods held at BHU, Varansi, (U.P.) during 8-9 April 2011.

National Seminar on Prospects and Retrospect of Small Ruminant and Rabbit production organized by ISSGPU at Jaipur during 7-9 Decmber 2011.

Saket Bhushan

International Conference on, "Emerging Trends on Food and Health Security in Cold Deserts" Organized by Defence Institute of High Altitude Research (DRDO), Leh - Ladakh held on 23-25 September, 2011 at Leh.

National Symposium on, "Role of Indigenous Animal Genetic Resources in Rural Food Security *vis-a-vis* Climate Change" Organized by Society for Conservation of Domestic Animal Biodiversity (SOCDAB) and BAIF development Research Foundation held on 24-25 February, 2012 at Pune.

S.D. Kharche

Visited on deputation as an expert in a bilateral programme for collaborative research between ICAR, India and GART, Zambia for imparting demonstrations and training on Artificial Insemination and management in goat and finalization of action plan to promote and accelerate the progress of research and development including training on various aspect of goat production and reproduction from 5th Nov., 2011 to 16th Nov., 2011 at Lusaka, Zambia.

Seminar on "Improved village/Rural Poultry and Goat Production" on 16th November, 2011 at Pamodzi Hotel in Lusaka, Zambia, organized by GART in collaboration with the Ministry of Agriculture and livestock and Indian High Commission of Zambia.

National Seminar on Reproductive Biotechnologies for augmenting fertility and conservation of animal species with special reference to North Eastern Hill regionand XXVII annuall convention of ISSARheld at CAU, Aizawl, Mizorum from 27th to 29th September, 2011.

S.K. Jindal

Annual Review Meeting of the Network Project on "Adaptation of livestock to impending climatic changes through Shelter Management" held on 6th July 2010 at NDRl, Karnal.

Meeting cum Workshop on " Towards more effective role of Heads of Divisions and Regional Stations in ICAR Institutes" organized at the Central Institute of Agricultural Engineering, Bhopal on 14-15 June, 2011 which was Chaired by Dr. S.Ayyappan, Secretary DARE and DG ICAR.

Executive committee meeting of ISSGPU held at CSWRI Avikanagar on 3.11.2011.

National Stakeholders consultation of Mission on Goat platform held at CIRG on 6.2.12.

S.K. Singh

AICRP (Goat) & Network meeting held at CIAE Bhopal on 15-06-2011 to 17-6-2011.

Workshop organized by ILRI, New Delhi to formulate project plan & survey of Uttrakhand sponsored by ILRI. 4-7-2011 to 8-7-2011.

XII Scientist Meet held at Bikaner on 3-08-2011 to 6-8-2011.

Organized Short Course Training on OOS/FSS Tools organized by AKMU Unit of CIRG Makhdoom from 14-23 Sept., 2011.

AICRP (Goat) meeting with DDG (AN) ICAR, New Delhi on 25-09-2011

AICRP (Goat) meeting with DG, ICAR, New Delhi on 14-15 Nov., 2011

Meeting of AO/FAOs ICAR, New Delhi on 21- 23 Nov., 2011.

Souvik Paul

International Conference on Emerging trends on Food and Health Security in Cold Deserts. Organised by DIHAR, DRDO at

Leh-Ladakh during 23rd-25th, September, 2011.

XXII National Congress of IAAVP and National Symposium on Integrated Research Approaches in Veterinary Parasitology: From basic to Molecular Techniques. Organised by IAAVP at DUVASU, Mathura during 15th-17th March, 2012.

S.V. Singh

11th International Colloquium on Paratuberculosis (ICP) Sydney (5 to 10, Feb., 2012).

VII Annual meeting of JDIP with dairy and animal science Joint Annual Meeting (JAM) on July 10 & 14, 2011, New Orleans, Louisiana, USA.

29th Meeting of the European Society of Veterinary Pathology & the European College of Veterinary Pathologists, and 9th European Congress of Toxicologic Pathology of the European Society of Toxicologic Pathology. Uppsala, Sweden. 7-10, Sept. 2011.

XVIII Annual convention f Indian Society of Veterinary Immunology and Biotechnology (ISVIB) & National Symposium on Effective utilization of translational research platforms for animal biotechnology, held at SDAU, Dantiwada, Gujarat, 12 to 14, Dec., 2011.

IAVMI Conference, Bangalore, June, 2011.

V. Raj Kumar

National Seminar on "Vet for Health; Vet for Food; Vet for the planet" held on November 19-21, 2011, at AP Shinde Auditorium, NASC Complex, PUSA, New Delhi.

National Seminar on "Prospects and Retrospect of Small Ruminant and Rabbit Production: Contribution to Socio-economic Security" held on December 7-9, 2011 at Hotel Royal Orchids, Jaipur, Rajasthan.

U.B. Chaudhary

Annual review meet of AICRP (FRN) and Network program on methane emission. Held at Nagpur, Maharashtra.

Annual Review Meet of VTCC (Rumen Microbes). Held at NAS complex, New Delhi on 4th December 2011.

IMPORTANT MEETINGS

Composition of the Research Advisory Committee (RAC)

Position	Status	Name and Designation
An eminent retired ICAR Scientist nominated by DG, ICAR	Chairman	Dr. V. Prabhakar Rao, Vice Chancellor, Sri Venkateswara Veterinary University, Tirupati (AP)
4-5 external members (including retired ADG, Director, Scientists representing the major areas of research and development programme of the institute nominated by DG, ICAR.	Members Member Secretary	1. Dr. N.Krishnan, Ex Associate Dean, Hyderabad (AP) 2. Dr. S.K.Dwivedi, Ex. Director, NRC on Equines, Hisar 3. Dr. R.J.Sharma, Ex. Dean, GBPUAT, Pantnagar (UK) 4. Dr. K.Kumanan, Prof. and Head, Madras Veterinary College, Chennai(TN) 5. Dr. S.N.Maurya, Former Vice Chancellor, DUVASU, Mathura(UP) 6. ADG (AN&P), ICAR, New Delhi 7. Dr. P.K.Rout, Principal Scientist, CIRG, Makhdoom

Composition of the Institute Management Committee (IMC)

Position	Status	Name and Designation
Director, CIRG, Makhdoom	Chairman	Dr. Devendra Swarup
Members include ADG, Former Head, Principal Scientist, Finance Account Officer & Administrative Officer representing the major areas of research and development programme of the institute nominated by DG, ICAR.	Member Member Secretary	1. Dr. N.N. Pathak, Former Director, CIRB, Hisar 2. Dr. H.N. Singh, Former Dean, Pt. Dean Dayal Upadhayay Pashu Chikitsa Vishwa Vidayalaya, Mathura (U.P.) 3. Dr. Dhirendra Singh, Principal Scientist, CSWRI, Avikanagar (Rajasthan) 4. Dr. Mahesh Kumar, Prof. & Head (VPM), GB Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar 5. Dr. Rajan Gupta, Principal Scientist , ICAR, Krishi Bhawan, New Delhi 6. Finance & Accounts Officer, CIRG, Makhdoom 7. Administrative Officer, CIRG, Makhdoom

Institute Research Committee (IRC)

Institute Research Council (IRC) meeting was held at the Institute from 9th to 10th May, 2011. The meeting aimed to review the progress made under different research projects. The progress of the research projects for the year 2010-11 was reviewed. In total the progress of 16 major research projects was presented by the respective principal investigators and collaborators. Six monthly Institute Research Council (IRC) Meeting of the Institute was held on 4.11.2011.

Institute Management Committee (IMC) Meeting

The Institute Management Committee meeting was held on 11th November, 2011 and several important decisions were taken.

Research Advisory Committee (RAC) Meeting

The meeting of Research Advisory Committee (RAC) of CIRG was held on 27.4.11 under the chairmanship of Dr. Arun Varma, Chairman RAC, Dr. V.K. Singh and Dr. K.P. Agrawal , members of RAC and Dr. Devendra Swarup, Director, CIRG, Makhdoom. Important suggestions regarding a 'Mission Project' on goat and other research related areas were discussed.

Director in discussion with Chairman R.A.C.

RESEARCH PROJECTS (2011-12)

A. Institute projects

Project No.	Project Title	Investigators	Date of start	Date of completion
GENETICS AND BREEDING DIVISION **XI/GGB-1: Evaluation and improvement of growth, milk, meat and skin traits in Indian goat breeds (Jamunapari, Barbari, Jakhrana, Beetal and Bengal goats) through multi disciplinary approach.**				
GGB-1.09	Improvement of sire evaluation of Jamunapari goats for milk & meat production (AICRP-Jamunapari).	R. Roy (P.I) upto 30.11.11, P.K.Rout (P.I), Gopal Dass and H.A. Tewari	1997-98	To continue
GGB-1.10	Genetic improvement of Barbari goats for meat & milk production (AICRP-Barbari)	S.K. Singh (P.I) and P.K. Rout	1997-98	To continue
XI/GGB-1.12	Improvement of Jakhrana breed of goats (*Capra hircus*) for milk and meat production under farm and field condition.	Saket Bhushan (PI). U.B. Chaudhary, Gopal Dass and A.K.Misra	April, 2007	March, 2012
AICRP on sheep improvement				
CIRG-10.01	AICRP on sheep improvement.	Gopal Dass (P.I.) N. Shivasharappa (upto 25.1.2012)	1997-98	To continue
XI/GGB- 2 Quantitative Trait Loci (QTL) mapping for production, reproduction and other traits in Indian goats				
XI/GGB- 2.01	Molecular analysis of major genes and Quantitative Trait Loci (QTL) influencing growth, reproduction and disease resistance traits in Indian goats	P.K. Rout (P.I), S.K. Singh , M.K.Singh and R.Roy (upto 30.11.11)	June, 2007	March, 2012
NUTRITION, FEED RESOURCES AND PRODUCTS TECHNOLOGY DIVISION **XI/NFRPT-1. Development of technologies for improving feed & fodder resources for goats.**				
XI/NFRPT-1.01	Development of fodder production, conservation and processing technologies for small holders and commercial goat farmers.	P. Tripathi (PI) T.K. Dutta (upto Jan, 2012)	April, 2007	March, 2012
XI/NFRPT-1.02	Development of feeding strategies for goats under intensive and semi-intensive systems.	T.K. Dutta (PI)(upto Jan, 2012) V.Raj Kumar	September, 2007	March, 2012

Project No.	Project Title	Investigators	Date of start	Date of completion
XI/NFRPT-2. Development of value addition and marketing of goat products.				
XI/NFRPT-2.01	Studies on nutritional value of goat milk.	R.B. Sharma (PI)	April, 2007	March, 2012
XI/NFRPT-2.02	Evaluation of carcass traits, meat quality and products from goat meat.	V.Rajkumar (PI) R.B. Sharma , A.K.Verma (from 25.10.10)	April, 2007	March, 2012
PHYSIOLOGY, REPRODUCTION AND SHELTER MANAGEMENT DIVISION **XI/PRSM-1: Improved productivity of goats through reproductive biotechnologies including refinement of frozen semen, strengthening of semen bank and augmentation of prolificacy.**				
XI/PRSM-1:	Studies on refinement of frozen semen technology and strengthening of goat semen bank.	S.K. Jindal (PI) S.D. Kharche A.K. Goel, N. Ramachandran Pridharshini Raju and Satish Kumar	April, 2007	March, 2012
XI/PRSM-1.02	Augmentation of prolificacy by using biotechnological tools in goats.	S.D. Kharche (PI) A.K. Goel, S.K. Jindal Pridharshini Raju	April, 2007	March, 2012
XI/PRSM-2.03	Economic managemental interventions for augmenting growth in kids	N. Ramachandran (PI), S.K. Singh, M.K. Tripathi, V. Rajkumar, Pridharshini Raju T.K. Dutta (upto January, 2012)		
GOAT HEALTH DIVISION				
XI/GH-1	Monitoring and surveillance of important goat diseases in India.	D.K. Sharma (PI), V.K. Gupta, Ashok Kumar , G.B. Manjunath Reddy, N. Shivasharnappa (upto Jan, 2012) and A.K.Mishra	April, 2007	March, 2012
XI/GH-2: Development of diagnostic kits, reagent and prophylactics using frontier technologies.				
XI/GH-2.1	Control of brucellosis in goats by molecular diagnosis and epidemiology.	V.K. Gupta (PI) S.V. Singh N.Shivasharanappa (2011-12)	July, 2007	2012

Project No.	Project Title	Investigators	Date of start	Date of completion
XI/GH-3:Development of contemporary alternative medicines for selective diseases.				
XI/GH-3.1	Modulation of caprine coccidiosis through herbal therapy.	D.K. Sharma (PI), Ashok Kumar	April, 2007	March, 2010 extended one year and further 6 months
XI/GH-3.2	Development of herbal anti-diarrhoeal drug for goat.	Ashok Kumar (PI), V.S. Vihan (upto 31.5.2011)	April, 2007	March, 2010 extended one year and further 6 months
EXTENSION EDUCATION & SOCIO-ECONOMICS SECTION XI/EESE- 1: Transfer of Technology and its impact on improving goat production.				
XI/EESE-1.03	Impact of improved technologies and emerging market conditions on goat production system.	Vijay Kumar (PI) A.K. Dixit (PI) Khushyal Singh M.K. Singh and Anil Kumar	April, 2007	March, 2011 extended upto 2011-12
XI/EESE-2: Organization of National and International training programmes and provision of consultancy services for improving goat production.				
TOT Proj. EESE/8.14	Multi – disciplinary project on transfer of technology for sustainable goat production system.	Braj Moan P.I, Ashok Kumar, Khushyal Singh, M.K. Singh, A.K. Goel, Ravindra Kumar, Vijay Kumar, R.B. Sharma, H. A. Tewari, N. Ramachandran and Anil Kumar	2009	2012

EXTERNALLY FUNDED PROJECTS

Funding Agency	Project Title	Investigators	Date of start	Date of completion
ICAR	AICRP on "Improvement of feed resources and nutrient utilization in raising animal production".	U.B. Chaudhary, T.K. Dutta, & Ashok Kumar, M.K. Tripathi (upto 29.7.11) Ravindra Kumar (wef 29.7.11)	2004 and September 2008 with modified technical programme)	March 2012
CSIR & DST (PP mode)	Development and Characterization of an Indigenous vaccine and diagnosis for Johne's disease(Collaboration with Biovet private Ltd. Banglore)	S.V. Singh (PI) Naveen Kumar	Aug. 2008	July 2011 extended upto May 2013
ICAR (NAIP)	Goat husbandry based integrated approach for livelihood security in disadvantaged districts of Bundelkhand region (Component-3)	M.K. Singh, A.K. Goel, A.K. Dixit, R.B. Sharma, S.B. Singh, Deepak Sharma, Sanjeev Kumar, A.K. Roy, Hritik Biswas	April, 2008	March,2012
Ministry of Food Processing	Nutritional approach for designing goat meat based functional products.(Ministry of Food Processing)	V. Rajkumar A.K. Verma	June.,2009	2011 extended upto Feb 2012
ICAR (Net work Project)	Adaptation of livestock to impending climatic changes through shelter management.	S.K.Jindal, N. Ramachandran Pridharshini Raju, Neeru Bhushan B.Rai	2008	2012
ICAR (Net work Project)	Estimation of Methane emission under different feeding systems and development of mitigation.	U.B. Chaudhary M.K. Tripathi (upto 29.7.2011) Ravindra Kumar (from 29.7.2011)	2008 (March)	2012
ICAR (NAIP)	Developmental potential of parthenogenetic goat embryos.	S.D. Kharche, A.K. Goel, S.K. Jindal Pridharshini Raju	Jan,2009.	2012

ICAR (NAIP)	Agroweb digital dissemination system for India	S.K. Singh	2008-09	
ICAR (NAIP)	Holistic approach for improving livelihood security through livestock based farming system in Barabanki and Rai Bareilly districts of U.P.	B Rai, M.K. Singh and Ashok Kumar	2009-10	2012-13
ICAR (NAIP)	Bioprospecting of genes and allele mining for abiotics stress tolerance	P.K. Rout N. Ramachandran S.K. Jindal	January 2009	2012
ICAR	Outreach programme on zoonotic diseases	S.V. Singh Naveen Kumar	2009-10	
ICAR-(Network Project)	1.Veterinary type cultures-Microbes	V.K. Gupta (P.I) Manjunatha Reddy (23.10.2010)	2009-10	
	2.Veterinary type culture-Rumen microbes	U.B. Chaudhary V.K. Gupta, T.K. Dutta	October 2009	March 2012
NICRA	Assessing resilience of small ruminant production under changing climatic conditions in semi arid zone	U.B.Chaudhary, N. Ramachandran P.K.Rout, Ashok Kumar	2011-12	2013-14
NAIP-3/XI/02	Achieving improved livelihood security through resource conservation and diversified farming system approach in Mewat	D.K.Sharma (PI) and P.K.Rout	2009-10	2012-13

CONSULTANCY, PATENTS AND COMMERCIALIZATION OF TECHNOLOGIES

During the year, 10 patent applications of various technologies generated by different scientists of the institute were filed with Controller of Patents, New Delhi. Details are as follows:

List of Patents Registered

S.N.	Title	Patent Application no.	Type of application
1.	Meat Murukku: a snack food	976/DEL/2012	Complete
2.	Method of preparing meat nimkee; a snack food product.	967/DEL/2012	Complete
3.	Method of preparing goat meat and milk biscuits	968/DEL/2012	Complete
4.	Use of herbal plant materials and extracts to prepare functional herbal based meat product	969/DEL/2012	Complete
5.	Goat milk fat and its use as fat substitute in emulsion based meat product	970/DEL/2012	Complete
6.	Process for preparation of aurvedic paneer	971/DEL/2012	Complete
7.	Process for preparation of aurvedic flavoured milk and whey drink	972/DEL/2012	Complete
8.	AJAS goat milk based natural beauty soap	973/DEL/2012	Provisional
9.	AJAS green goat milk based natural herbal beauty soap	974/DEL/2012	Provisional
10.	AJAS antiseptic goat milk based natural herbal antiseptic soap	975/DEL/2012	Provisional

Institute participated in ICAR Industry Meet held at NASC complex, New Delhi . In this meet institute show cased the technologies developed by the institute scientists.

Technologies Commercialized

1. 'Indigenous Vaccine' against Johne's disease of ruminants.

2. 'Indigenous ELISA kit' for the diagnosis of Johne's disease in animals.

Transfer of Strain for Commercial Exploitation

MOU signed and strain ('Indian Bison type' genotype of Mycobacterium avium subspecies paratuberculosis strain 'S 5' transferred to M/S Biovet (P) Ltd., Malur.

Writing of SOPs for IP Vet

SOPs were prepared for making of Johne's disease vaccine using strain ('Indian Bison type' genotype of Mycobacterium avium subspecies paratuberculosis strain 'S 5' with M/S Biovet (P) Ltd., Malur.

Validation of ELISA kit: 'Indigenous ELISA kit' developed by CIRG, Makhdoom for the diagnosis of Johne's disease in animals was validated from PD-ADMAS, Bengaluru, VPH Division, IVRI, Izatnagar and Veterinary College, Trichur (Kerala).

DISTINGUISHED VISITORS

Following distinguished guests paid a visit to the Institute, during 2011-12 :

- Dr. Arun Varma, Former ADG, ICAR, and Chairman RAC (27.4.2011).
- Dr. K.P. Agrawal, Former National Co–ordinator, NATP, Delhi and member RAC (27.4.2011).
- Dr. V.K. Singh, Former Director, CSWRI and member RAC (27.4.2011).
- Mr. Sandeep Dixit, Hon'ble Member of Parliament (29.4.2011).
- Dr. N.V. Patil, Director, NRC on Camel (7.6.2011 and 4.2.2012).
- Dr. A.P. Singh, Vice Chancellor, DUVASU, Mathura (12.7. 2011).
- Prof. M.J. Modayil, Chairman, ASRB, New Delhi (12.8.2011).
- Mr. Chaman Kumar, Additional Secretary and Financial Advisor, ICAR/DARE (14.8.2011).
- Dr. Harnam Singh, Dean, College of Veterinary Science & A.H., Faizabad (7.9.2011).
- Dr. Gajendra Singh, Former DDG (Eng.) (14.9.2011).
- Dr. P. Ballenty, ILRI, Ethiopia (16.9.2011).
- Dr. K. Kumanan, Member RAC (27.9.2011).
- Dr. N. Krishnan, Member RAC (27.9.2011).
- Dr. V. Prabhakar Rao, Chairman, RAC (27.9.2011).
- Dr. S.K. Dwivedi, Former Director NRC on Equines and Member RAC (28.9.2011).
- Dr. Sudhir Kumar, Secretary, AH and Fisheries, Govt. of Bihar (4.10.2011).
- Dr. N.K. Bhattacharyya, Former Director, CIRG (14.10. 2011).
- Dr. A.K. Singh, Zonal Coordinator, Zone IV, Kanpur (20.10.2011 and 17.3.2012).
- Dr. Kirti Singh, Ex. Chairman, ASRB, New Delhi (22.10.2011).
- Dr. M.P. Yadav, Ex. Director, IVRI and Ex. V.C., SVPUA&T (22.10.2011).
- Dr. K. Pradhan, Ex. VC, OUAT (9.2.2012).
- Dr. Michael Blummel, ILRI (8.2.2012).
- An 11 member delegation from Kandhar, Afganistan (13.3.2012).
- Dr. K.M.L. Pathak, DDG (AS) (18.2.2012 and 17.3.2012).
- Dr. K.D. Kokate, DDG (Extension) (17.3.2012).
- Dr. B.S. Prakash, ADG (Animal Nutrition and Physiology) (30.3.2012).

PERSONNEL

Administration

Dr. D. Swarup	Director
Dr. A.K. Goel	Vigilance Officer
Dr. P.K. Rout	Scientific Secretary
Mr. R.N. Mallik	Administrative Officer
Mr. Rajesh Dubey	Finance and Accounts Officer (upto 20.10.2012)
Mr. Joseph George	Finance and Accounts Officer (w.e.f. 13.2.2012)
Mr. S.S. Gautam	Asstt. Admn. Officer
Mr. C.S. Sagar	Asstt. Admn. Officer
Mr. A.K. Sharma	Asstt. Admn. Officer
Mr. S.R. Achary	Private Secretary
Mr. Kailash Chandra	Jr. Finance and Accounts Officer

Goat Genetics and Breeding Division

Dr. R. Roy	Principal Scientist and Head (upto 30.11.2011)
Dr. S.K. Singh	Principal Scientist and Head (w.e.f. 1.12.2011)
Dr. P.K. Rout	Principal Scientist
Dr. Saket Bhushan	Principal Scientist
Dr. Gopal Dass	Senior Scientist
Dr. M.K. Singh	Senior Scientist
Mr. Badan Singh	Technical Officer T-5
Mr. A.S. Prajapati	Technical Officer T-5
Mr. Ram Das Bharti	Technical Officer T-5

Physiology, Reproduction and Shelter Management Division

Dr. S.K. Jindal	Principal Scientist and Head
Dr. Satish Kumar	Principal Scientist
Dr. A.K. Goel	Principal Scientist
Dr. B. Rai	Principal Scientist
Dr. S.D. Kharche	Senior Scientist
Dr. N. Ramachandran	Scientist
Dr. Ravi Ranjan	Scientist (on study leave)
Dr. S.P. Singh	Scientist (on study leave)
Dr. Priyadharsini Raju	Scientist
Mr. Krishan Kumar	Technical Officer T-5
Mr. H.K. Himkar	Technical Officer T-5
Mr. Rajendra Kumar	Technical Officer T-5
Mr. Hari Om	Technical Officer T-5

Nutrition, Feed Resources and Products Technology Division

Dr. U.B. Chaudhary	Principal Scientist and Head
Dr.T.K. Dutta	Principal Scientist (upto Jan. 2012)
Dr. M.K. Tripathi	Senior Scientist
Dr. R.B. Sharma	Senior Scientist
Dr. Prabhat Tripathi	Senior Scientist
Dr. Ravindra Kumar	Senior Scientist
Dr. V. Rajkumar	Scientist (Sr. Scale)
Dr. A.K. Das	Scientist

Dr. A.K. Verma	Scientist
Mr. Suresh Tewari	Technical Officer T 7-8
Mr. Dori Lal Gupta	Technical Officer T-6
Mr. Raj Kumar Singh	Technical Officer T-5
Mr. Suraj Pal	Technical Officer T-5

Goat Health Division

Dr. V.S. Vihan	Principal Scientist and Head (upto 31.5.2011)
Dr. S.V. Singh	Principal Scientist and Head (w.e.f. 1.6.2011)
Dr. Ashok Kumar	Principal Scientist
Dr. D.K. Sharma	Principal Scientist
Dr. R.V.S. Pawaiya	Principal Scientist
Dr. V.K. Gupta	Senior Scientist
Dr. Naveen Kumar	Senior Scientist
Dr. K. Gururaj	Scientist (on study leave)
Dr. N. Shivsharnappa	Scientist (on study leave)
Dr. Manjunatha Reddy	Scientist
Dr. A.K.Mishra	Scientist
Dr. Souvik Pal	Scientist
Dr. (Mrs.) Nikita Sharma	Scientist
Dr. H.A. Tiwari	Senior Veterinary Officer
Dr. Vinay Chaturvedi	Veterinary Officer

Extension Education and Socio-Economics Section

Dr. Braj Mohan	Principal Scientist and I/c
Dr. A.K.Dixit	Senior Scientist
Dr. Khushyal Singh	Scientist (Sr. Scale)
Dr. Vijay Kumar	Scientist
Mr. Dinesh Prasad	Technical Officer T-6
Mr. U.C. Yadav	Technical Officer T-5

AICRP on Goat Improvement

Dr. S.K.Singh	Principal Scientist

Network Project on Sheep Improvement

Dr. Gopal Dass	Senior Scientist

Priortization Monitoring and Evaluation Section

Dr. P.K. Rout	Principal Scientist and I/c
Dr. Souvik Pal	Scientist
Dr. H.S. Sisodiya	Technical Officer T 7-8
Dr. Balraj Singh	Technical Officer T-6

IPR Cell

Dr. V.K. Gupta	Senior Scientist and I/c

RTI Cell

Dr. V.K. Gupta	Senior Scientist and Transparency Officer
Dr. H.A. Tiwari	Senior Veterinary Officer and PIO

Agriculture Knowledge Management Unit (AKMU)

Dr. S.K. Singh	Principal Scientist and I/c
Mr. M.P. Agrawal	Technical Officer T-5

Mr. Satish Chandra	Technical Officer T-5

Maintenance

Dr. U.B. Chaudhary	Principal Scientist and I/c
Mr. Jagdish Singh	Technical Officer T-5

Security Section

Dr. R.B. Sharma	Senior Scientist and I/c
Mr. P.K. Sharma	Security Officer

Medical Section

Dr. V.K. Gupta	Senior Medical Officer
Mr. C.B. Pandey	Technical Officer T-6
Mr. Mohan Lal	Technical Officer T-5

Library

Dr. M.K. Tripathi	Senior Scientist & I/C (upto Nov, 2011)
Dr. A.K. Goel	Principal Scientist and I/c (W.e.f. Nov, 2011)
Dr. Pratap Singh	Technical Officer, T-9

Agriculture Farm

Dr. T.K. Dutta	Principal Scientist and I/c (upto January, 2012)
Dr. Prabhat Tripathi	Senior Scientist and I/c (w.e.f. January 2012)
Mr. Bhagwan Singh	Technical Officer T-7-8

Transfer

Dr. T.K. Dutta	Principal Scientist transferred as Head, ERS, NDRI, Kalyani (January 2012)
Dr. Neeru Bhushan	Senior Scientist transferred to IARI (w.e.f. 20.12.2011)
Mr. Rajesh Dubey	Finance and Accounts Officer (w.e.f. 20.10.2011)

Joining

Dr. Naveen Kumar	Senior Scientist (w.e.f. 19.7.2011)
Dr.Anupam K. Dixit	Senior Scientist (w.e.f. 21.4.2011)
Dr. Ravindra Kumar	Senior Scientist (w.e.f. 8.4.2011)
Dr. Satish Kumar	Principal Scientist (w.e.f. 13.12.2011)
Dr. Vinay Chaturvedi	Veterinary Officer (w.e.f. 30.5.2011)
Mr. Suraj Pal	Technical Officer T-5
Mr. Satish Chandra	Technical Officer T-5

Superannuation

Dr. V.S.Vihan	Principal Scientist (31.5.2011)
Dr. Ramadhar Roy	Principal Scientist (30.11.2011)

Career Advancement / Promotion

Dr. Neeru Bhushan	Senior Scientist
Mr. C.B. Pandey	T (7-8)
Mr. Suresh Tewari	T (7-8)
Mr. Bhagwan Singh	T(7-8)
Mr. S.S.Gautam	AAO
Mr. C.S. Sagar	AAO
Mr. A.K.Sharma	AAO

Deputation Abroad

Dr. A.K.Das	Scientist
Dr. M.K.Tripathi	Senior Scientist
Dr. R.V.S. Pawaiya	Principal Scientist
Dr. S.D. Kharche	Senior Scientist

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